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IOWA'S AIR '75

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16. ABSTRACT

Iowa's air monitoring data from 1959 to 1975 has been compiled in this report for the six major pollutants monitored in the State: suspended particulates, sulfur dioxide, nitrogen dioxide, carbon monoxide, hydrocarbons and photochemical oxidants. The data is presented in tabular form for each of the twelve Air Quality Control Regions in the State. To help the reader better understand the large amount of technical information in this report, additional sections discussing the pollutants and pollutant sources, the air monitoring network, and the analysis of data and trends have been added. Brief summaries of other Departmental projects, such as development of air basin modeling and investigation of pollution caused by leaf burning, are also included.

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iowa department of environmental quality

July 30, 1976

Citizens of Iowa:

The 1975 Iowa Air Quality Report was developed by the staff of the Air Quality Management Division of the Iowa Department of Environmental Quality to inform the public of Iowa's air quality for the previous year. This manual contains a summary of air monitoring data collected in Iowa from 1957 to 1975 and more detailed analysis of data collected during 1975.

This report is based upon analyses performed by the State Hygienic Laboratory, University of Iowa, Iowa City; by the Air Pollution Division of the Des Moines-Polk County Health Department; by the Air Pollution Division of the Linn County Health Department; and by the Environmental Protection Agency's National Air Surveillance Network. Monitor operation and maintenance for Scott County was conducted by the Quad Cities Regional Air Pollution Control Board, Rock Island, Illinois. Special recognition should also be given to the many local monitoring equipment operators who, in large part, volunteer their services.

It is hoped that this report will be both a source of information and a guide for further air quality improvement in Iowa.

Sincerely,

AIR QUALITY MANAGEMENT DIVISION

Edward J. Stanek, II
Director

EJS:MRD:jlw

3920 Delaware Ave., P.O. Box 3326, Des Moines, Iowa 50316 • 515/265-8134

PREFACE

The intent of this report is to supply information regarding Iowa's air quality to Iowans with a wide range of technical backgrounds and interests. Technical terminology is used in some places to provide those with an interest in air pollution chemistry the opportunity to have precise information available. Readers who have no interest in this area should find the report quite informative and less confusing by skipping over the sections which are technically complex.

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I. AMBIENT AIR QUALITY STANDARDS

The National Ambient Air Quality Standards (NAAQS) were established by the U.S. Environmental Protection Agency in 1971, as required by the Clean Air Act of 1970. These standards were developed for six pollutants: suspended particulates, sulfur dioxide, carbon monoxide, nitrogen dioxide, hydrocarbons, and photochemical oxidants. Each standard specifies a concentration and an exposure time which were developed from research on the physiological effects of various pollutant levels.

The NAAQS for the six pollutants are separated into two categories, primary and secondary. Primary ambient air quality standards define levels of air quality which are necessary to protect the public health from adverse effects of a pollutant. Secondary ambient air quality standards, which are generally more restrictive than primary, define levels of air quality which are necessary to protect the public welfare from adverse effects of a pollutant. For some pollutants, the primary and the secondary standards are identical. Neither the primary nor secondary air quality standards, excluding annual means, are to be exceeded more than once per year. Table 1 lists the NAAQS for the six pollutants listed above.

TABLE I

NATIONAL PRIMARY AND SECONDARY
AMBIENT AIR QUALITY STANDARDS*

Suspended Particulates

Primary	Secondary	
a) 75 $\mu g/m^3$	a) 60 $\mu g/m^3$	Annual geometric mean.
b) 260 $\mu g/m3$	b) 150 $\mu g/m^3$	Maximum 24-hour concentration not to be exceeded more than once per year.

Sulfur Dioxide

Primary	Secondary	
a) 80 $\mu g/m^3$ (0.03 ppm)		Annual arithmetic mean.
b) 365 $\mu g/m^3$ (0.14 ppm)		Maximum 24-hour concentration not to be exceeded more than once per year.
	1300 $\mu g/m^3$ (0.5 ppm)	Maximum 3-hour concentration not to be exceeded more than once per year.

Carbon Monoxide

Primary and Secondary	
a) 10 mg/m^3 (9 ppm)	Maximum 8-hour concentration not to be exceeded more than once per year.
b) 40 mg/m^3 (35 ppm)	Maximum 1-hour concentration not to be exceeded more than once per year.

Photochemical Oxidants

Primary and Secondary	
160 $\mu g/m^3$ (0.08 ppm)	Maximum 1-hour concentration not to be exceeded more than once per year.

Hydrocarbons

Primary and Secondary	
160 $\mu g/m^3$ (0.24 ppm)	Maximum 3-hour concentration (6 to 9 a.m.) not to be exceeded more than once per year.

Nitrogen Dioxide

Primary and Secondary	
a) 100 $\mu g/m^3$ (0.05 ppm)	Annual arithmetic mean.

*Published in the Federal Register, Vol. 36, No. 84, Part II - Friday, April 30, 1971; Revised in the Federal Register, Vol. 38, No. 178, Part I - Friday, September 14, 1973.

II. POLLUTANT DESCRIPTIONS AND MONITORING METHODS

Suspended Particulates

Any solid or liquid matter of relatively small particle size (usually .001 to .1 millimeters) that tends to stay suspended and dispersed in the atmosphere for a significant length of time is considered a suspended particulate. Suspension time may vary from a few seconds to several months, depending on particle size. Sources of this pollutant include combustion, industrial processes, agricultural activities, and unpaved roads.

Particulate pollution has adverse effects on climate, property, vegetation and human health. Large concentrations of particulate matter promote cloud formation and reduce solar radiation, thus causing possible climate changes. Atmospheric particles may accelerate corrosion of iron, steel and various nonferrous metals, disfigure and damage building materials, and soil painted and textile surfaces. Particulates may prevent normal plant growth by intercepting light needed for photosynthesis. It has also been shown that suspended particulates will cause or promote respiratory ailments.

The method of collection consists of a high volume vacuum pump motor that is designed to continuously draw a large volume of air (1 to 2 cubic meters/min.) through a preweighed glass fiber filter for a 24-hour period (usually midnight to midnight). The sample filter is then sent to the laboratory, where it is held at least 24 hours at 75° F and less than 50% relative humidity before it is weighed again. The weight difference is the amount of particulates, measured in micrograms. Combined with the calculated volume of air that passed through the filter during the 24 hour period, the amount of suspended particulate matter can be expressed in micrograms per cubic meter. Minimum detectable limit for this method is one microgram per cubic meter.

Sulfur Oxides (Sulfur Dioxide)

Sulfur oxides are common atmospheric pollutants that consist of sulfur dioxide, sulfur trioxide, and the corresponding acids and salts (sulfites and sulfates). The most common sulfur oxide monitored is sulfur dioxide.

Sulfur dioxide is a nonflammable, colorless gas that most people can detect by taste or odor. The largest man-made source of this pollutant is produced from combustion of solid and liquid fossil fuels. Other less significant sources are manufacturing of sulfuric acid and refining of petroleum.

Sulfur oxides have adverse effects on property, vegetation, and human health. Much of the damage to property and vegetation is due to the conversion of sulfur oxides to highly reactive sulfuric acid. This acid tends to accelerate both corrosion in metals and decay in building materials, textile fibers, leather, and other miscellaneous materials. The sulfuric acid will cause injury to leaf tissues, thus suppressing vegetative growth and yield. Sulfur oxides have also been shown to cause irritation of the human respiratory system, producing possible temporary or permanent injury.

The 24-hour sampling method collects sulfur dioxide by bubbling ambient air samples through an absorbing solution of potassium tetrachloromercurate. This collected sample is then analyzed in the laboratory by adding pararosaniline and formaldehyde which react with the complexed sulfur ion to form a red/purple color. The intensity of the color is proportional to the sulfur dioxide that was originally absorbed out of the bubbled air. This color intensity is measured spectrophotometrically and results are reported in micrograms per cubic meter. The detection limit for this method is five micrograms per cubic meter.

The continuous sulfur dioxide instrumentation method used at stations in Iowa is the Environmental Protection Agency reference method known as the coulometric method. It involves the detection of electric current differences in an electrochemical reaction. This reaction occurs in a cell containing platinum electrodes and a potassium iodide solution. Ambient air is bubbled through this detection cell at a known rate of flow, and the sulfur dioxide in the sample changes the electrical properties of the solution. A detectable electric current between the platinum electrodes results, which is proportional to the sulfur dioxide concentration in the continuously drawn sample of ambient air. The results are reported in parts per million. The detection limit for this method is 26 micrograms per cubic meter.

Carbon Monoxide

Carbon monoxide (CO) is a colorless, odorless, tasteless gas that is very flammable. It is the most commonly occuring air pollutant, with total emissions exceeding all other pollutants combined.

Carbon monoxide is produced by both natural sources and technological sources. In nature, CO has been found to be produced from volcanos, natural gases from coal mines, electrical storms and lightning related forest fires. Small quantities are also formed during some seed germinations and aquatic plant growth. The largest quantities of carbon monoxide, however, are the result of fuel combustion in mobile sources utilizing the internal combustion engine.

Since carbon monoxide is a toxic gas, large concentrations can be fatal to humans and animals. Carbon monoxide, like oxygen, reacts with hemoproteins in the blood; an increase in carbon monoxide exposure will cause a decrease in oxygen in the blood. A lack of oxygen in the blood for extended periods of

time may cause damage to the brain, central nervous system, and cardiovascular system and may eventually cause death.

Monitoring for carbon monoxide is done on a continuous basis using instrumentation based on the ability of the carbon monoxide molecule to absorb infrared radiation of a specific wavelength. A beam of infrared radiation is split into two paths; one is passed through a cell containing a sample of air, the other is used as a reference. After the beam passes through the air sample, the difference in the radiation intensities of the two beams is measured, using a special detector that is sensitive to varying levels of this radiation. The output of this detector is an electronic signal that is proportional to the carbon monoxide in the air sample reported in milligrams per cubic meter. Minimum detectable concentration is equal to 0.6 micrograms per cubic meter.

Photochemical Oxidants (Ozone)

Ozone is one of the highly reactive oxidants that is produced in the atmosphere by the chemical combination of hydrocarbons, nitrogen oxide and sunlight. Ozone is not only a pollutant in itself, but, because it is almost entirely produced as a result of other pollutants (NO_2 and Hydrocarbons), it serves as an indicator of their presence. In addition, ozone is more reliably monitored than the pollutants that cause its formation.

Photochemical oxidants have adverse effects on property, vegetation, and human health. Ozone is reactive with rubber, cellulose in textile fabrics, and certain dyes, causing decay or chemical alteration. In vegetation, oxidants have been shown to cause injury to leafy vegetables and field crops by destroying plant cells. This effect increases growth alterations, reduces yields and changes the quality of plant products. Photochemical oxidants will also cause injury to humans by altering or impairing normal respiratory processes.

The continuous detector method used is chemiluminescence. In this method, the air sample is mixed with ethylene gas in a reaction chamber. If there is ozone in the sample, it will combine with the ethylene in a photochemical reaction. Light is emitted from the reaction at a rate proportional to the amount of ozone present. This light energy is measured in a photomultiplier tube which gives results indicative of levels of ozone in parts per million (ppm). The minimum detectable concentration is 0.001 ppm.

There is also a bubbler method for detecting all oxidants (ozone is a specific oxidant, others are chlorine and hydrogen peroxides). Air samples are bubbled through an absorbing solution of sodium hydroxide and potassium iodide which is mixed with sulfuric acid and phosphoric acid later in the laboratory to produce a yellow color proportional to the oxidant level. This color is also measured spectrophotometrically.

Nitrogen Oxides (Nitrogen Dioxide)

Nitrogen oxides are atmospheric pollutants that consist of nitric oxide, nitrogen dioxide, and other less significant oxides of nitrogen. The only nitrogen oxide present in the atmosphere in appreciable concentrations is nitrogen dioxide. Nitrogen dioxide is a reddish-orange-brown gas that has a pungent odor. It is very corrosive, highly oxidizing, and is irritating and toxic.

Nitrogen oxides are produced from fuel combustion. Fossil fuel burning stationary sources and fuel combustion from mobile sources are the two largest contributors. A small amount of nitrogen oxides are also produced naturally by bacterial action.

Textile dyes, natural and synthetic fibers, and metals have been shown to be affected by nitrogen oxides. Nitrogen dioxide has been shown to cause injury

to vegetation by destroying plant cells. This effect increases growth alterations, reduces yields, and changes the quality of the plant products. In humans, nitrogen oxides, like ozone, will cause injury by altering or impairing normal respiratory processes.

The method for monitoring nitrogen dioxide is a 24-hour bubbler method which is now only a tentative EPA reference method. It consists of an absorbing solution of sodium hydroxide-sodium arsenite which is later reacted with phosphoric acid, sulfanilamide and other compounds to form a dye which can be evaluated colorimetrically. The results are reported in micrograms per cubic meter, with the minimum detection capability of five micrograms per cubic meter.

Hydrocarbons

Hydrocarbons are organic compounds that consist of atoms of hydrogen and carbon. Many of these compounds enter into photochemical reactions and produce photochemical air pollutants.

Hydrocarbons originate primarily from incomplete fuel combustion (e.g. carburated gasoline engines), organic solvent loss (e.g., chemical manufacturing, rubber and plastic production, paint, varnish and lacquer usage, and drycleaning materials), and petroleum production, processing, storage, and transfer.

Since many hydrocarbons enter into the formation of photochemical air pollution, effects on materials, vegetation, and humans are similar to that of photochemical oxidants.

The Environmental Protection Agency has not established a reference method for monitoring hydrocarbons. However the method used in Iowa involves gas chromography with flame ionization detection. Since the principle hydrocarbon

component, methane, is inert in photochemical reaction, it is desirable to monitor it separately to obtain an accurate measurement of photochemically reactive hydrocarbons. A quantity of ambient air is passed through a separating column to separate the methane from the other hydrocarbons. This methane gas is measured by a flame ionization detector. A second quantity of ambient air is passed directly to the flame ionization detector to measure total hydrocarbons. Total non-methane hydrocarbons are then calculated by subtracting the measured methane value from the total hydrocarbon value.

III. AIR MONITORING NETWORK

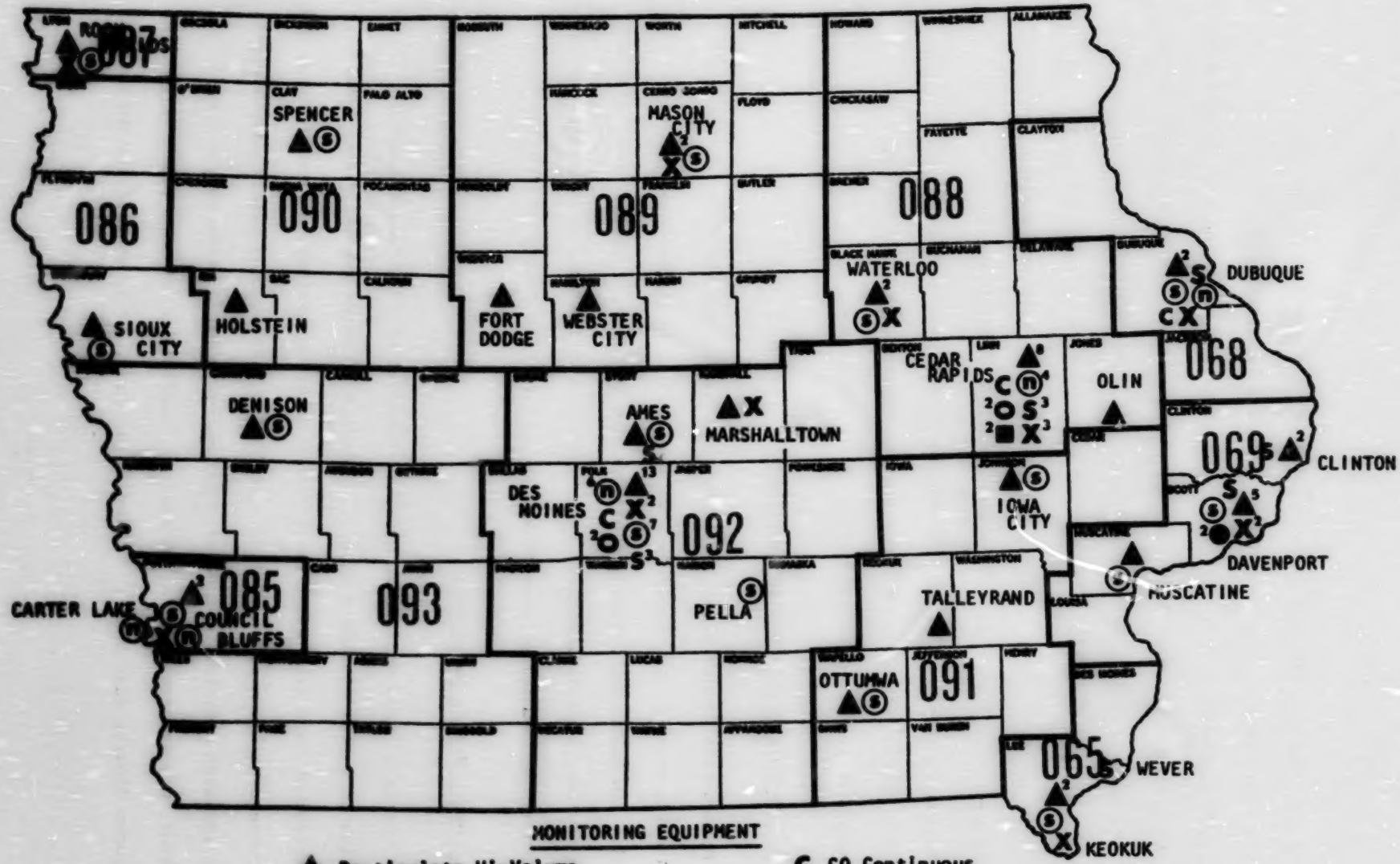
The 1975 Iowa Air Monitoring Network consisted of 115 monitors at 65 sites in 38 cities. The network has been thoroughly reviewed to ensure that sampling locations meet EPA guidelines. At some of the existing sites, the monitors were repositioned or the sampler inlets were modified to comply with federal recommendations. Eighteen new monitoring sites were also selected. Four began operation in late 1975, while the remaining fourteen began operation in early 1976. Continued review and modification is expected to improve the monitoring network and monitoring data.

Monitor operations are conducted by five agencies in Iowa: State Hygienic Laboratory (SHL), Des Moines-Polk County Health Department (DMPC), Linn County Health Department (LCHD), Quad Cities Area Regional Air Pollution Control Board (QCAP), and Environmental Protection Agency's National Air Surveillance Network (EPA). These agencies were responsible for monitor maintenance, data acquisition, and data reporting. Figure 1 is an illustration of the Iowa Air Monitoring Network.

State Hygienic Laboratory

The largest part of the State's air monitoring is conducted by the State Hygienic Laboratory. In 1975, SHL maintained a fixed monitoring network consisting of 24 Hi-Volume samplers, 12 sulfur dioxide gas bubblers, 7 continuous sulfur dioxide monitors, 2 nitrogen dioxide gas bubblers, 7 coefficient of haze tape samplers and 1 carbon monoxide monitor. In addition to the fixed stations, the SHL maintained a mobile laboratory capable of monitoring suspended particulates (both Hi-Volume and tape sampler), continuous sulfur dioxide, continuous nitrogen dioxide, continuous carbon monoxide, continuous non-methane hydrocarbons and wind speed and direction. This mobile unit makes it possible to

Figure 1. Air monitoring stations operated during 1975.



The number nearest symbol indicates multiple monitors of that type.

survey all types of problem areas and emergency situations for which fixed station monitoring is not available. During 1975 and through the date of this publication, the State Hygienic Laboratory has been expanding the fixed station network. Eleven new Hi-Volume samplers and three new continuous sulfur dioxide monitors have been located throughout the State for additional monitoring data. Several of these were installed and data has been received prior to the end of 1975. In addition, many monitors were relocated because of a study conducted in the summer of 1975 that indicated improper placement and location of some monitoring equipment. During 1975 and early in 1976, a total of 42 monitors were installed, moved, or adjusted in some way as a part of DEQ's quality assurance program for the air quality sampling network.

Des Moines-Polk County Health Department

Des Moines-Polk County Health Department is one of the three local agencies conducting monitoring. In 1975, DMPC operated 11 Hi-Volume samplers, 5 sulfur dioxide gas bubblers, 5 nitrogen dioxide gas bubblers, 1 coefficient of haze tape sampler, 2 ozone monitors, and 1 carbon monoxide monitor. This monitoring equipment was located in nine cities throughout Polk County.

Linn County Health Department

Linn County's fixed monitoring network consisted of 6 Hi-Volume samplers, 2 continuous sulfur dioxide monitors, 1 nitrogen dioxide gas bubblers, 2 coefficient of haze tape samplers, 1 carbon monoxide monitor, 1 ozone monitor and 1 non-methane hydrocarbon monitor. LCHD also maintained a mobile laboratory that included a Hi-Volume sampler, continuous sulfur dioxide monitor, ozone monitor, non-methane hydrocarbon monitor, coefficient of haze tape sampler, and nitrogen dioxide gas bubbler. However, in April, 1975, most of the monitoring

equipment from the mobile laboratory was installed permanently in the Linn County Health Department's office.

Quad Cities Area Regional Air Pollution Control Board

In cooperation with the State Hygienic Laboratory, the Quad Cities air pollution agency operates 5 Hi-Volume samplers, 1 sulfur dioxide continuous monitor, 1 sulfur dioxide gas bubbler, 2 coefficient of haze tape samplers and 2 total oxidant monitors in the Davenport area. This monitoring equipment includes a mobile monitoring unit donated to the local agency by Iowa-Illinois Gas and Electric. This unit is equipped to monitor suspended particulates, sulfur dioxide, total oxidants, carbon monoxide, and wind speed, direction, and temperature. The Quad Cities agency is also responsible for reporting data to the Illinois Environmental Protection Agency.

National Air Surveillance Network

The U.S. Environmental Protection Agency's National Air Surveillance Network consisted of five sites in Iowa. All sites have a Hi-Volume sampler and two sites, Des Moines and Dubuque, also have a sulfur dioxide gas bubbler and nitrogen dioxide gas bubbler. All samples are analyzed by EPA and reported to the state agency.

IV DATA SUMMARY

Data Interpretation

A compilation of air monitoring data through 1975 is listed by Air Quality Control Region (AQCR) in the following sections. Each section consists of a map of the AQCR showing cities where air quality monitoring is being done, a directory of monitoring data, and graphs illustrating trends in air quality. In the tables of monitoring data, years that have insufficient data to be used as an annual statistic representative of air quality for that year are designated by an asterisk (*).

Figure 1 may be used to locate cities and AQCR's in which monitoring equipment is located.

Monitoring Data by Air Quality Control Regions

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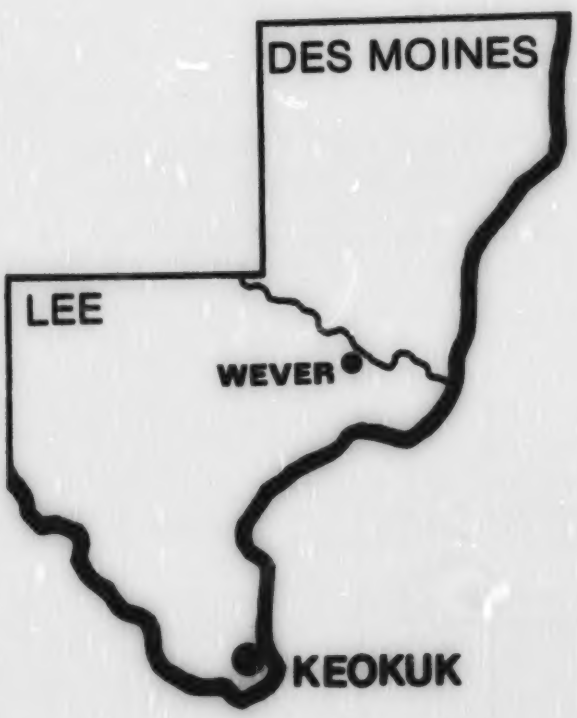
AQCR 065 Burlington - Keokuk Interstate	15-18
AQCR 068 Metropolitan Dubuque Interstate	19-22
AQCR 069 Metropolitan Quad Cities Interstate	23-28
AQCR 085 Metropolitan Omaha-Council Bluffs Interstate	29-31
AQCR 086 Metropolitan Sioux City Interstate	32-34
AQCR 087 Metropolitan Sioux Falls Interstate	35-37
AQCR 088 Northeast Iowa Intrastate	38-45
AQCR 089 Northcentral Iowa Intrastate	46-49
AQCR 090 Northwest Iowa Intrastate	50-52
AQCR 091 Southeast Iowa Intrastate	53-55
AQCR 092 Southcentral Iowa Intrastate	56-68
AQCR 093 Southwest Iowa Intrastate	69-71

AQCR 065

BURLINGTON – KEOKUK INTERSTATE



Keokuk

2 Particulate Hi-Volume
1 Particulate - Tape
1 SO_2 Bubbler

Wever

1 SO_2 Continuous

Site Location	Address	Agency	Equipment	Environment
Des Moines County				
Wever Pump House		SHL	SO_2 Cont.	Industrial
Lee County				
Keokuk Water Pollution Control Plant	1000 Mississippi Drive	SHL	Hi-Vol SO_2 Bubbler Tape Sampler	Industrial
Keokuk Water Treatment Plant	415 Blondeau Street	SHL	Hi-Vol	Commercial

SUSPENDED PARTICULATES - 24 HOUR SAMPLES
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	No. of Samples > 24 Hr. Std. Secondary	No. of Samples > 24 Hr. Std. Primary	Arith. Mean	Geo. Mean	SGD+
Lee County									
Keokuk Water Pollution Control Plant									
	1970*	7	327.0	262.0	2	2	174	159	1.
	1971*	17	840.0	559.0	2	2	145	86	2.
	1972	38	667.0	655.0	11	6	166	118	2.
	1973	40	648.5	351.0	17	5	156	119	1.
	1974	54	458.0	377.0	18	5	133	97	2.
	1975	54	387.0	377.0	19	7	143	118	1.
Keokuk Water Treatment Plant									
	1971*	7	95.8	73.9	0	0	58	55	1.
	1972	50	299.0	150.0	1	1	73	64	1.
	1973	43	223.0	221.0	5	0	85	74	1.
	1974	56	196.0	157.0	2	0	75	67	1.
	1975	58	202.0	147.0	1	0	78	71	1.

*Do not use as annual statistics representative of air quality for that year because four valid quarters not available.

+Standard Geometric Deviation

> represents greater than

COEFFICIENT OF HAZE - 2 HOUR CONTINUOUS SAMPLES
(COHS/1000 Linear Feet)

Site Location	Year	No. of Samples	Max. 2 Hr.	2nd Max. 2 Hr.	Arith. Mean
Lee County					
Keokuk Water Pollution Control Plant	1973	4204	0.910	0.820	0.081
	1974	3856	0.820	0.740	0.091
	1975	2255	1.220	1.090	0.098

SULFUR DIOXIDE - 24 HOUR SAMPLES
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	No. of Samples >24 Hr. Std.	Arith. Mean
Lee County						
Keokuk Water Pollution Control Plant	1973*	35	103.0	67.0	0	10.0
	1974	55	1240.0	338.0	1	70.6
	1975	50	273.0	151.0	0	25.8

SULFUR DIOXIDE - 1 HOUR CONTINUOUS SAMPLES
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 3 Hr.	2nd Max. 3 Hr.	No. of Samples >3 Hr. Std.	Max. 24 Hr.	2nd Max. 24 Hr.	No. of Samples >24 Hr. Std.	Arith. Mean
Des Moines County									
Wever Pump House	1973*	2473	379.0	346.8	0	159.0	36.6	0	7.1
	1974	7037	488.7	355.5	0	179.8	140.3	0	12.0
	1975	5567	165.7	52.3	0	35.0	33.0	0	7.1

*Do not use as annual statistics representative of air quality for that year because four valid quarters not available.

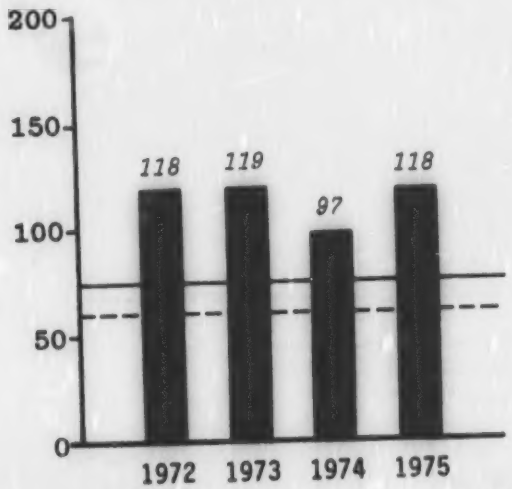
> represents greater than

GRAPHICAL TRENDS OF ANNUAL GEOMETRIC MEANS OF SUSPENDED PARTICULATES
MICROGRAMS PER CUBIC METER

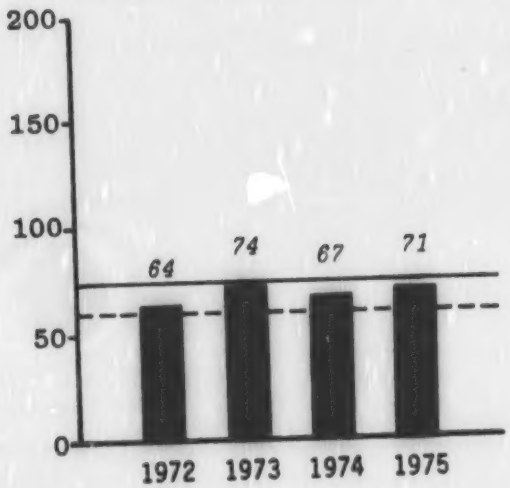
PRIMARY
STANDARD 75 ———

SECONDARY
STANDARD 60 ------

KEOKUK
WATER POLLUTION CONTROL PLANT

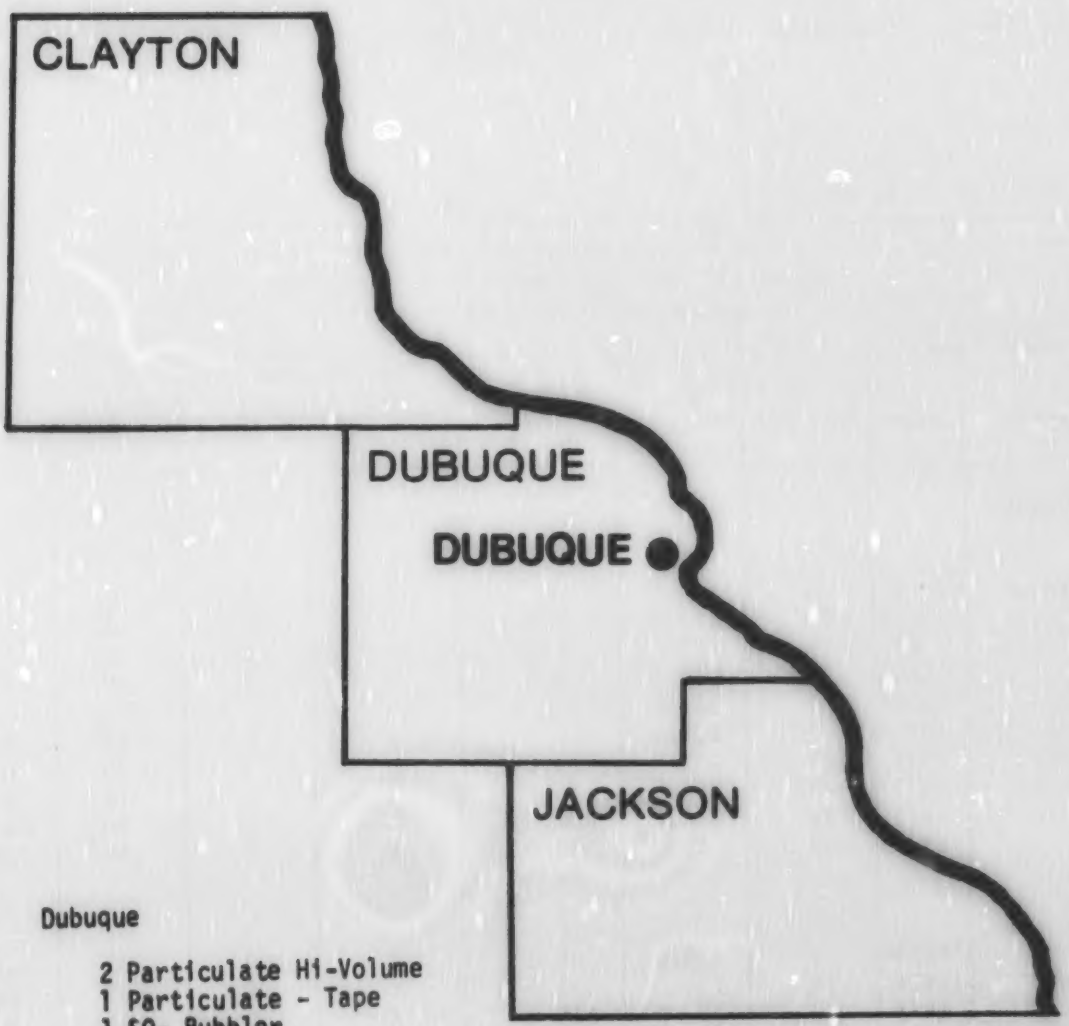


KEOKUK
WATER TREATMENT PLANT



AQCR 068

METROPOLITAN DUBUQUE INTERSTATE



Dubuque

2 Particulate Hi-Volume
1 Particulate - Tape
1 SO_2 Bubbler
1 SO_2 Continuous
1 NO_x Bubbler
1 CO Continuous

AQCR 068 METROPOLITAN DUBUQUE INTERSTATE REGION

Site Location	Address	Agency	Equipment	Environment
Dubuque County				
Dubuque City Garage	925 Kerper	SHL	Tape Sampler	Industrial
Dubuque Fire Station #4	University & Atlantic	EPA	Hi-Vol	Residential
Dubuque Eagle Pt. Pump Station	Hawthorne & Rhomberg	SHL EPA	SO_2 Cont. Hi-Vol SO_2 Bubbler NO_2 Bubbler	Industrial
Dubuque Pixler Electric	11 Bluff Street	SHL	CO Cont.	Commercial

SUSPENDED PARTICULATES - 24 HOUR SAMPLES
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24Hr.	No. of Samples >24 Hr. Std.		Arith. Mean	Geo. Mean	SGD+
					Secondary	Primary			
Dubuque County									
Dubuque Fire Station #4	1964	24	161.0	-	-	0	74	67	1.63
	1967*	25	163.0	-	-	0	60	54	1.59
	1968	15	222.0	-	-	0	61	46	2.27
	1969	23	268.0	-	1	1	79	70	1.63
	1970*	11	383.0	-	-	-	132	107	1.96
	1971*	3	139.0	-	0	0	93	89	2.17
	1972	24	231.0	174.0	3	0	76	64	1.76
	1973*	5	102.0	53.0	0	0	52	47	1.63
	1974	28	112.0	102.0	0	0	56	49	1.74
	1975	32	93.0	88.0	0	0	44	38	1.81
Dubuque Eagle Pt. Pump Station	1973*	4	39.0	36.0	0	0	31	30	1.32
	1974	28	134.0	132.0	0	0	53	44	1.82
	1975	33	126.0	119.0	0	0	46	39	1.76

*Do not use as annual statistics representative of air quality for that year because four valid quarters not available.

+Standard Geometric Deviation.

> represents greater than

COEFFICIENT OF HAZE - 2 HOUR CONTINUOUS SAMPLES
(COHS/1000 Linear Feet)

Site Location	Year	No. of Samples	Max. 2 Hr.	2nd Max. 2 Hr.	Arith. Mean
Dubuque County					
Dubuque					
City Garage	1973*	442	1.27	1.09	0.15
	1974	2316	0.91	0.82	0.09
	1975*	1083	1.18	1.00	0.10

SULFUR DIOXIDE - 24 HOUR SAMPLES
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	No. of Samples >24 Hr. Std.	Arith. Mean
Dubuque County						
Dubuque						
Eagle Pt. Pump	1974	26	121.0	36.0	0	16.1
Station	1975	32	112.0	73.0	0	24.7

SULFUR DIOXIDE - 1 HOUR CONTINUOUS SAMPLES
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 3 Hr.	2nd Max. 3 Hr.	No. of Samples >3 Hr. Std.	Max. 24 Hr.	2nd Max. 24 Hr.	No. of Samples >24 Hrs. Std.	Arith Mean
Dubuque County									
Dubuque									
Eagle Pt.	1973*	753	318	233	0	102	91	0	32
Pump	1974	4813	624	523	0	354	350	0	53
Station	1975	4140	484	420	0	230	149	0	9

NITROGEN DIOXIDE - 24 HOUR SAMPLES
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	Violation of Standard	Arith. Mean
Dubuque County						
Dubuque						
Eagle Pt.	1974	26	55.0	51.0	No	27.4
Pump Station	1975	34	62.0	43.0	No	24.3

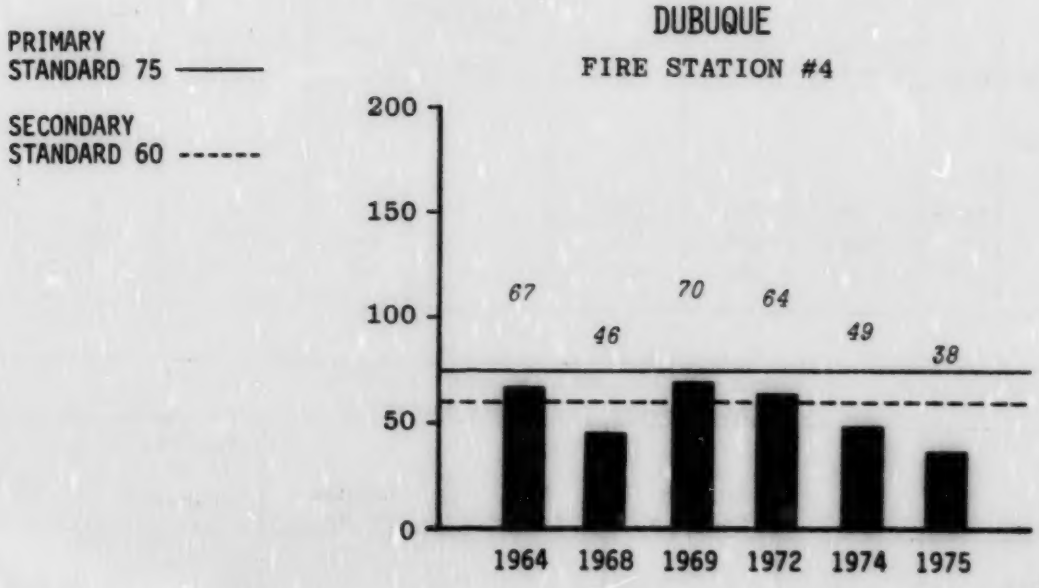
Do not use as annual statistics representative of air quality for that year because four
id quarters not available.
presents greater than

CARBON MONOXIDE - 1 HOUR CONTINUOUS SAMPLES (Parts Per Million)									
Site Location	Year	No. of Samples	Max. 1 Hr.	2nd Max. 1 Hr.	No. of Samples >1 Hr. Std.	Max. 8 Hr.	2nd Max. 8 Hr.	No. of Samples >8 Hr. Std.	Arith. Mean
Dubuque County									
Dubuque Pixler Electric	1975*	4165	13.2	12.7	0	10.6	6.9	1	1.9

*Do not use as annual statistics representative of air quality for that year because four valid quarters are not available.

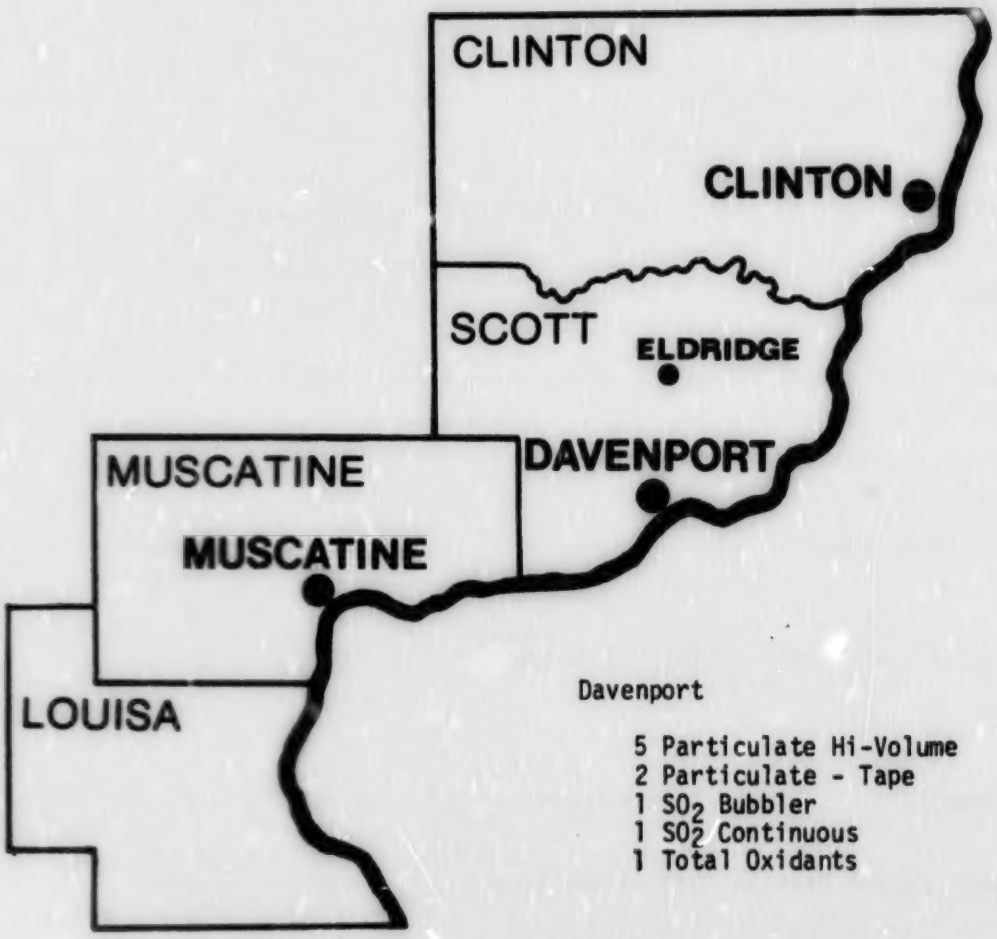
> represents greater than

GRAPHICAL TRENDS OF ANNUAL GEOMETRIC MEANS OF SUSPENDED PARTICULATES
MICROGRAMS PER CUBIC METER



AQCR 069

METROPOLITAN QUAD CITIES INTERSTATE



Davenport

5 Particulate Hi-Volume
2 Particulate - Tape
1 SO_2 Bubbler
1 SO_2 Continuous
1 Total Oxidants

Eldridge

1 Total Oxidants

Clinton

2 Particulate Hi-Volume
1 SO_2 Continuous

Muscatine

1 Particulate Hi-Volume
1 SO_2 Bubbler

AQCR 069 METROPOLITAN QUAD CITIES INTRASTATE REGION

Site Location	Address	Agency	Equipment	Environment
Clinton County				
Clinton Sewage Treatment Plant	1901 Beaver Channel Parkway	SHL	Hi-Vol	Industrial
Clinton Water Plant	120 5th Ave. S.	SHL	Hi-Vol	Industrial
Clinton Central Fire	N. 4th St. & 3rd Ave S.	SHL	SO_2 Cont.	Commercial
Muscatine County				
Muscatine City Hall	E. 3rd & Sycamore	SHL	Hi-Vol SO_2 Bubbler	Commercial
Scott County				
Eldridge North Scott High School	200 S. First Street	SHL[a]	Total Oxidants	Residential
Bettendorf Pleasant Valley School	Belmont Road	SHL[a]	Hi-Vol	Residential
Davenport Central Fire Station	331 Scott	EPA SHL[a]	Hi-Vol Hi-Vol	Commercial
Davenport Ia.-Ill. Gas & Electric	Third & Pershing	SHL[a]	Hi-Vol Tape Sampler SO_2 Bubbler	Commercial
Davenport Monroe School	1946 West 4th	SHL[a]	Hi-Vol	Industrial
Davenport Ia. Highway Patrol Station	3200 Block Elmore	SHL[a]	Hi-Vol Tape Sampler SO_2 Cont. Total Oxidants	Commercial

[a]Monitoring equipment maintained by Quad Cities Area Regional Air Pollution Control Board.

SUSPENDED PARTICULATES - 24 HOUR SAMPLES
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	No. of Samples >24 Hr. Std.		Arith. Mean	Geo. Mean	SGD+
					Secondary	Primary			
Clinton County									
Clinton Sewage Treatment Plant	1975	50	265.0	206.0	5	1	80	67	1.81
Clinton Water Plant	1970	26	178.0	142.0	1	0	78	72	1.58
	1971	33	114.0	89.2	0	0	53	47	1.73
	1972	52	132.0	112.0	0	0	41	37	1.82
	1973	45	121.0	93.0	0	0	45	40	1.63
	1974	54	159.0	120.0	1	0	57	48	1.8?
	1975	53	122.0	109.0	0	0	57	53	1.51
Clinton Central Fire Station	1975*	2	47.4	32.2	0	0	40	37	1.31
Muscatine County									
Muscatine City Hall	1975*	2	48.4	36.0	0	0	42	42	1.23
Scott County									
Bettendorf Pleasant Valley School	1974	48	148.0	147.0	0	0	63	54	1.75
	1975	60	150.0	106.0	0	0	54	48	1.61
Davenport Central Fire Station (SHL)	1974*	17	384.0	193.0	3	1	118	99	1.83
	1975*	21	184.0	152.0	2	0	96	90	1.50
Davenport Central Fire Station (EPA)	1958	20	276.0	-	-	1	133	125	1.43
	1961	26	237.0	-	-	0	111	95	2.00
	1963	25	270.0	-	-	1	114	102	2.00
	1964	23	313.0	-	-	-	166	150	1.60
	1966	25	238.0	-	-	0	121	109	2.00
	1968	24	291.0	-	-	-	153	139	1.56
	1969	26	319.0	288.0	13	4	170	152	2.00
	1970	25	302.0	-	14	3	165	148	1.65
	1971*	23	1128.0	865.0	-	5	239	169	2.22
	1972	26	340.0	326.0	12	3	147	127	1.77
	1973*	5	156.0	81.0	1	0	74	64	1.77
	1974	28	228.0	193.0	7	0	114	101	1.78
	1975	35	207.0	198.0	3	0	94	84	1.64

> represents greater than

*Do not use as annual statistics representative of air quality for that year because four valid quarters not available.

ndard Geometric Deviation.

SUSPENDED PARTICULATES - 24 HOUR SAMPLES (CONTINUED)
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	No. of Samples >24 Hr. Std.		Arith. Mean	Geo. Mean	SGD+
					Secondary	Primary			
Davenport Ia.-Ill. Gas & Electric	1970	27	229.0	183.0	6	0	119	112	1.42
	1971	32	350.0	270.0	7	2	117	101	2.00
	1972	55	230.0	216.0	7	0	109	101	1.47
	1973	43	228.0	220.0	14	0	114	107	3.08
	1974	44	194.0	194.0	6	0	94	84	1.63
	1975	54	225.0	182.0	3	0	91	85	1.49
Davenport Monroe School	1974	58	211.0	201.0	8	0	95	78	1.78
	1975	59	150.0	136.0	0	0	67	61	1.59
Davenport Ia. Highway Patrol Station	1974*	47	184.0	156.0	3	0	68	61	1.61
	1975	56	166.0	166.0	3	0	66	58	1.61

COEFFICIENT OF HAZE - 2 HOUR CONTINUOUS SAMPLES
(COHS/1000 Linear Feet)

Site Location	Year	No. of Samples	Max. 2 Hr.	2nd Max. 2 Hr.	Arith. Mean
Scott County					
Davenport Ia.-Ill. Gas & Electric	1973*	1944	0.91	0.82	0.16
	1974	3022	1.18	1.18	0.13
	1975	3422	2.70	1.30	0.19
Davenport Ia. Highway Patrol Station	1974*	1970	1.90	1.70	0.27
	1975	4343	1.30	1.30	0.23

*Do not use as annual statistics representative of air quality for that year because four valid quarters not available.

+Standard Geometric Deviation.

> represents greater than

SULFUR DIOXIDE - 24 HOUR SAMPLES
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max 24 Hr.	No. of Samples >24 Hr. Std.	Arith Mean
Muscatine County						
Muscatine City Hall	1975*	1	12.5	-	0	12.5
Scott County						
Davenport Ia.-Ill. Gas & Electric	1973	46	31.0	0.0	0	0.7
	1974	52	36.7	15.8	0	6.9
	1975	56	48.2	41.1	0	8.9

SULFUR DIOXIDE - 1 HOUR CONTINUOUS SAMPLES
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 3 Hr.	2nd Max. 3 Hr.	No. of Samples >3 Hr. Std.	Max. 24 Hr.	2nd Max. 24 Hr.	No. of Samples >24 Hr. Std.	Arith. Mean
Scott County									
Davenport Ia. Highway Patrol Station	1974*	2423	260	183	0	149	125	0	30
	1975	5783	293	267	0	183	175	0	53
Clinton Central Fire Station	1975*	368	1240	660	0	237	22	0	10

*Do not us as annual statistics representative of air quality for that year because four valid quarters not available.

> represents greater than

TOTAL OXIDANTS - 1 HOUR CONTINUOUS SAMPLES (Micrograms Per Cubic Meter)						
Site Location	Year	No. of Samples	Max. 1 Hr.	2nd Max. 1 Hr.	No. of Samples >1 Hr. Std.	Arith. Mean
Scott County						
Eldridge Eldridge High School	1975*	1533	216	214	15	56.0
Davenport Ia. Highway	1974*	3866	140	140	0	34.8
Patrol Station	1975	8491	202	190	20	49.6

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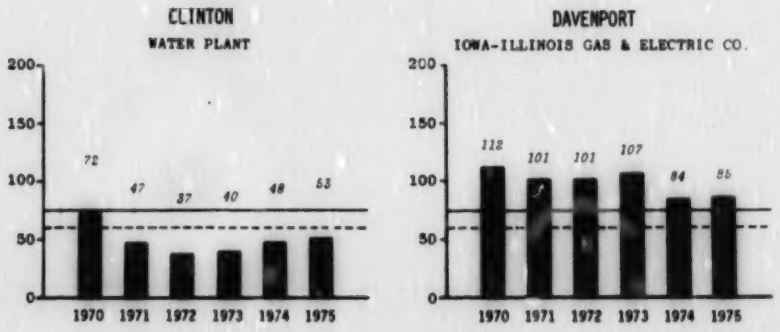
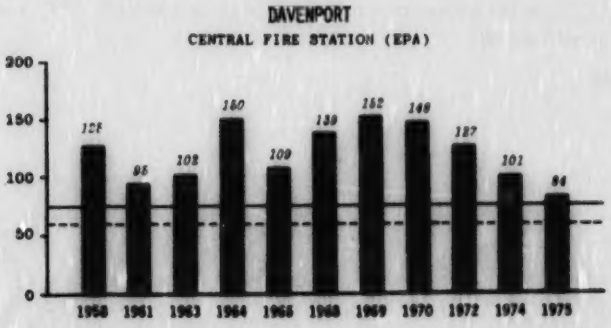
> represents greater than

GRAPHICAL TRENDS OF ANNUAL GEOMETRIC MEANS OF SUSPENDED PARTICULATES
MICROGRAMS PER CUBIC METER

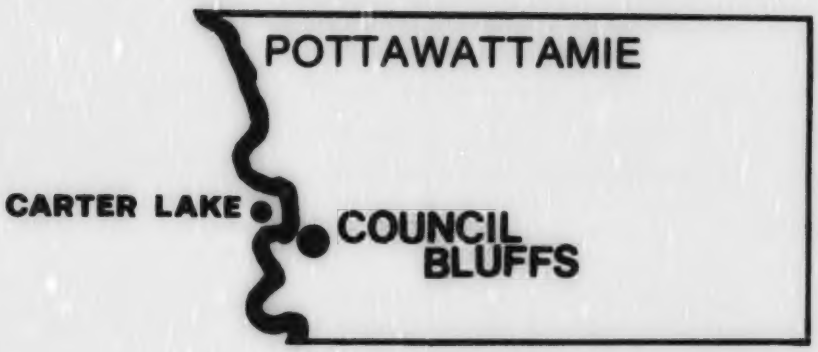
PRIMARY STANDARD 75 ——— SECONDARY STANDARD 60 ------





AQCR 085

METROPOLITAN
OMAHA — COUNCIL BLUFFS INTERSTATE



Council Bluffs

- 2 Particulate Hi-Volume
- 1 Particulate - Tape
- 1 SO_2 Bubbler
- 1 NO_x Bubbler

Carter Lake

- 1 NO_x Bubbler

Site Location	Address	Agency	Equipment	Environment
Pottawattamie County				
Carter Lake City Hall	626 Locust St.	SHL	NO_2 Bubbler	Commercial
Council Bluffs City Hall	209 Pearl St.	SHL	Hi-Vol Tape Sampler SO_2 Bubbler	Commercial
Council Bluffs Dodge Park Lift Station	Dodge Park	SHL	Hi-Vol NO_2 Bubbler	Industrial

SUSPENDED PARTICULATES - 24 HOUR SAMPLES
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	No. of Samples >24 Hr. Std. Secondary	No. of Samples >24 Hr. Std. Primary	Arith. Mean	Geo. Mean	SGD+
Pottawattamie County									
Council Bluffs City Hall	1970*	17	233.0	190.0	4	0	122	99	1.48
	1971*	18	205.0	136.0	1	0	101	96	1.52
	1972*	21	217.0	176.0	6	0	116	94	2.39
	1973*	42	243.0	218.9	9	0	114	103	1.66
	1974	51	293.0	293.0	15	3	133	121	1.56
	1975	33	337.0	282.0	10	3	132	115	1.72
Council Bluffs Dodge Park Lift Station	1973*	31	188.0	178.0	2	0	77	65	1.85
	1974	53	744.0	587.0	12	4	129	99	1.92
	1975	35	263.0	211.0	7	1	109	95	1.75

COEFFICIENT OF HAZE - 2 HOUR CONTINUOUS SAMPLES
(COHS/1000 Linear Feet)

Site Location	Year	No. of Samples	Max. 2 Hr.	2nd Max. 2 Hr.	Arith. Mean
Council Bluffs City Hall	1973*	1953	1.020	1.000	0.204
	1974	3229	0.780	0.740	0.115
	1975	665	0.320	0.280	0.071

*Do not use as annual statistics representative of air quality for that year because four valid quarters not available.

+Standard Geometric Deviation.

> represents greater than

SULFUR DIOXIDE - 24 HOUR SAMPLES
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	No. of Samples >24 Hr. Std.	Arith. Mean
Pottawattamie County						
Council Bluffs City Hall	1973*	35	34.7	29.9	0	1.8
	1974	55	46.2	15.5	0	5.0
	1975	42	41.1	28.7	0	9.4

NITROGEN DIOXIDE - 24 HOUR SAMPLES
(Micrograms Per Cubic Meter)

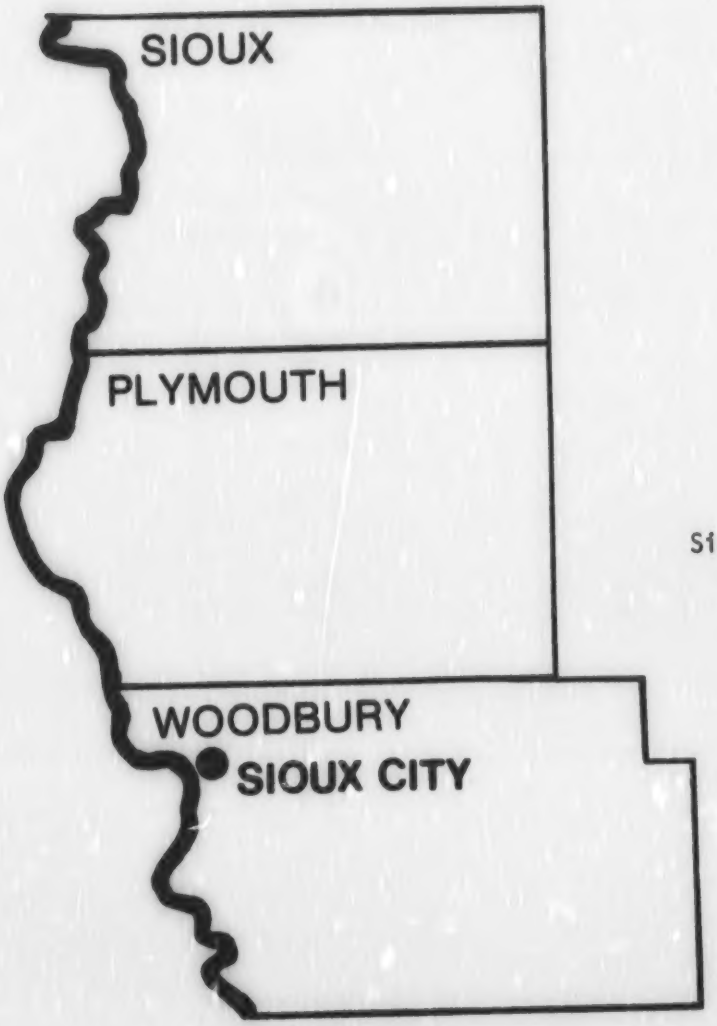
Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	Violation of Standard	Arith. Mean
Pottawattamie County						
Carter Lake City Hall	1973*	25	138.1	119.2	No	29.3
	1974	26	174.0	112.0	No	32.6
	1975*	21	35.9	34.0	No	13.1
Council Bluffs Dodge Park Lift Station	1973*	25	50	45.9	No	24.8
	1974	46	85.7	63.8	No	26.2
	1975	31	42.3	30.9	No	10.6

*Do not use as annual statistics representative of air quality for that year because four valid quarters not available.

> represents greater than

AQCR 086

METROPOLITAN SIOUX CITY INTERSTATE



Sioux City

1 Particulate Hi-Volume
1 SO_2 Bubbler

Site Location	Address	Agency	Equipment	Environment
Woodbury County				
Sioux City City Hall	405 - 6th St.	SHL	Hi-Vol SO_2 Bubbler	Commercial

SUSPENDED PARTICULATES - 24 HOUR SAMPLES
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	No. of Samples >24 Hr. Std.		Arith. Mean	Geo. Mean	SGD+
					Secondary	Primary			
Woodbury County									
Sioux City City Hall	1970*	19	131.0	110.0	0	0	76	71	1.44
	1971*	31	168.0	139.0	1	0	79	73	1.00
	1972	50	128.0	120.0	0	0	66	59	1.70
	1973	57	218.0	189.1	5	0	77	66	1.73
	1974	61	151.0	123.0	1	0	58	52	1.61
	1975	53	160.0	135.0	1	0	59	50	1.79

SULFUR DIOXIDE - 24 HOUR SAMPLES
(Micrograms Per Cubic Meter)

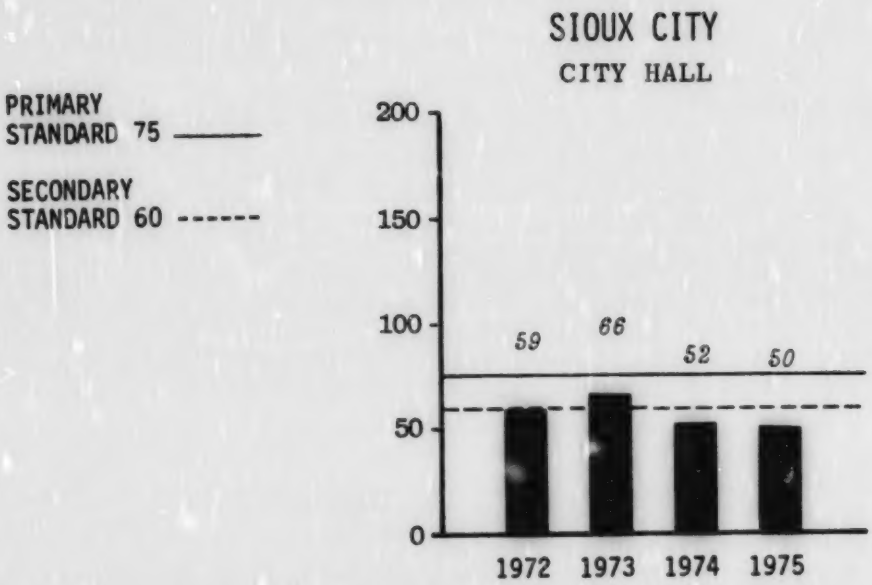
Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	No. of Samples >24 Hr. Std.	Arith. Mean	Std. Dev.
Woodbury County							
Sioux City City Hall	1973	40	0	0	0	0.0	0.0
	1974	59	21.8	12.5	0	4.1	6.2
	1975	55	12.5	12.5	0	4.8	6.1

*Do not use as annual statistics representative of air quality for that year because four valid quarters not available.

+Standard Geometric Deviation.

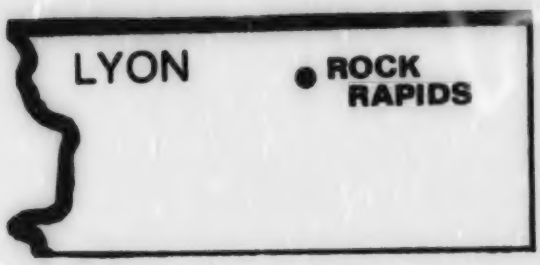
> represents greater than

GRAPHICAL TRENDS OF ANNUAL GEOMETRIC MEANS OF SUSPENDED PARTICULATES
MICROGRAMS PER CUBIC METER



AQCR 087

METROPOLITAN SIOUX FALLS INTERSTATE



Rock Rapids

1 Particulate Hi-Volume
1 Particulate - Tape
1 SO_2 Bubbler

AQCR 087 METROPOLITAN SIOUX FALLS INTERSTATE REGION

Site Location	Address	Agency	Equipment	Environment
Lyon County				
Rock Rapids Municipal Utilities Bldg.	311 S. 3rd	SHL	Hi-Vol SO_2 Bubbler Tape Sampler	Commercial

SUSPENDED PARTICULATES - 24 HOUR SAMPLES
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	No. of Samples >24 Hr. Std.		Arith. Mean	Geo. Mean	SGD+
					Secondary	Primary			
Lyon County									
Rock Rapids Municipal Utilities Building	1973	45	443.4	188.1	3	1	59	43	2.15
	1974	52	185.0	153.0	2	0	68	54	2.13
	1975	48	155.0	154.0	2	0	58	51	1.63

COEFFICIENT OF HAZE - 2 HOUR CONTINUOUS SAMPLES
(COHS/1000 Linear Feet)

Site Location	Year	No. of Samples	Max. 2 Hr.	2nd Max. 2 Hr.	Arith. Mean
Lyon County					
Rock Rapids Municipal Utilities Building	1973	1553	1.00	0.48	-
	1974	3434	1.64	1.64	0.064
	1975*	1208	0.32	0.28	0.064

SULFUR DIOXIDE - 24 HOUR SAMPLES
(Micrograms Per Cubic Meter)

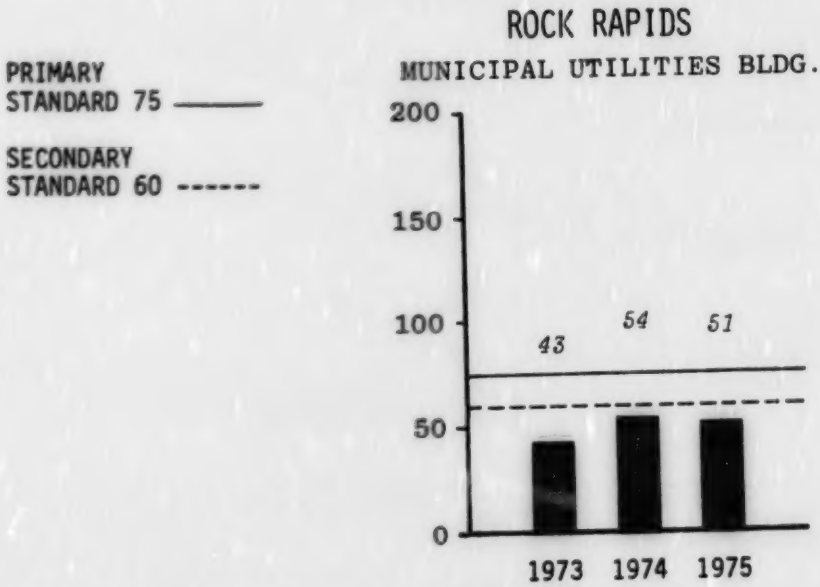
Site Location	Year	No. of Samples	Max. 2 Hr.	2nd Max. 2 Hr.	No. of Samples >24 Hr. Std.	Arith. Mean	Std. Dev.
Lyon County							
Rock Rapids Municipal Utilities Building	1973*	37	34	0	0	0.9	5.6
	1974	60	43.7	15.4	0	4.9	7.9
	1975	55	12.5	12.5	0	5.0	6.2

*Do not use as annual statistics representative of air quality for that year because four valid quarters not available.

+Standard Geometric Deviation.

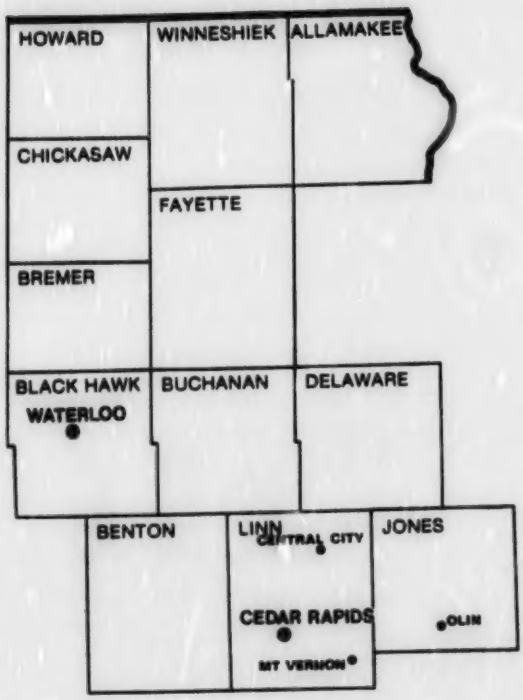
> represents greater than

GRAPHICAL TRENDS OF ANNUAL GEOMETRIC MEANS OF SUSPENDED PARTICULATES
MICROGRAMS PER CUBIC METER



AQCR 088

NORTHEAST IOWA INTRASTATE



Waterloo

- 2 Particulate Hi-Volume
- 1 Particulate - Tape
- 1 SO_2 Bubbler

Olin

- 1 Particulate Hi-Volume

Cedar Rapids *

- 6 Particulate Hi-Volume
- 3 Particulate - Tape
- 4 NO_x Bubbler
- 3 SO_2 Continuous
- 1 CO Continuous
- 2 Ozone
- 2 Total Hydrocarbons

Central City

- 1 Particulate Hi-Volume

Mt. Vernon

- 1 Particulate Hi-Volume

*The following represent the number of sampling sites which were used during 1975 and not the number of discrete instruments.

AQCR 088 NORTHEAST IOWA INTRASTATE REGION

Site Location	Address	Agency	Equipment	Environment
Black Hawk County				
Waterloo Water Plant	3rd and Water	SHL	Hi-Vol Tape Sampler SO_2 Bubbler	Commercial
Waterloo County Courthouse	316 E. 5th	EPA	Hi-Vol	Commercial
Jones County				
Olin Fire Station		SHL	Hi-Vol	Residential
Linn County				
Cedar Rapids Noelridge Park	4426 Council St. N.E.	LCHD	Hi-Vol	Residential
Cedar Rapids City Garages	445 - First St. S.W.	LCHD	Hi-Vol Tape Sampler SO_2 - Continuous NO_2 - Bubbler	Industrial
Cedar Rapids Jane Boyd Community Center	14th Ave. & 10th St. SE	LCHD	Hi-Vol NO_2 - Bubbler	Industrial
Cedar Rapids Linn County Health Department[b]	751 Center Point Rd. NE	LCHD	Hi-Vol Tape Sampler SO_2 - Continuous NO_2 - Bubbler CO - Continuous Ozone THC - CH_4	Industrial
Cedar Rapids Mobile Trailer[b]	28th St. & 1st Ave. NE	LCHD	Hi-Vol Tape Sampler SO_2 - Continuous NO_2 - Bubbler Ozone THC - CH_4	Commercial
Cedar Rapids City Garages	445 - First St. SW	EPA	Hi-Vol	Industrial
Central City Fire Station	80 Fourth Street	LCHD	Hi-Vol	Residential
Mt. Vernon City Hall	213 - 1st St. W	LCHD	Hi-Vol	Commercial

[b]Mobile Trailer operated only three months at 28th Street and 1st Avenue NE in 1975, then was installed permanently at 751 Center Point Road NE.

SUSPENDED PARTICULATES - 24 HOUR SAMPLES
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	No. of Samples >24 Hr. Std.		Arith. Mean	Geo. Mean	SGD+
					Secondary	Primary			
Blackhawk County									
Waterloo Water Plant	1970*	23	161.0	158.0	2	0	100	92	1.52
	1971	33	238.0	221.0	4	0	98	86	1.67
	1972*	46	354.0	278.0	12	3	126	107	1.79
	1973	46	421.5	191.0	6	1	85	76	1.59
	1974	58	174.0	166.0	3	0	85	76	1.67
	1975	58	232.0	188.0	3	0	88	80	1.54
Waterloo 316 E. 5th	1972*	19	249.0	156.0	2	0	114	107	1.40
	1973*	5	99.0	56.0	0	0	57	53	1.42
	1974	29	342.0	130.0	1	1	77	63	1.74
	1975	34	222.0	137.0	1	0	84	75	1.63
Jones County									
Olin Fire Station	1970*	5	132.0	106.0	0	0	90	88	1.50
	1971*	8	171.0	133.0	1	0	108	100	2.00
	1972*	25	181.0	179.0	5	0	106	92	1.84
	1973	53	229.0	188.0	4	0	88	79	1.64
	1974	60	220.0	196.0	2	0	74	64	1.79
	1975	54	226.0	172.0	5	0	83	74	1.63
Linn County									
Cedar Rapids Noelridge Park	1972*	35	160.0	146.0	1	0	69	60	1.74
	1973	49	228.5	162.3	2	0	78	70	1.58
	1974	55	193.3	149.1	1	0	67	63	1.63
	1975	58	173.0	163.5	3	0	71	62	1.73
Cedar Rapids City Garage	1972*	38	311.0	230.0	13	1	128	118	1.52
	1973	60	520.5	403.9	17	6	135	111	1.82
	1974	59	379.5	333.6	17	4	133	115	1.75
	1975	55	365.0	219.7	8	1	114	104	1.56
Cedar Rapids Jane Boyd Comm. Center	1972*	30	256.0	226.0	13	0	130	115	1.67
	1973	49	274.3	263.4	15	2	132	123	1.47
	1974	60	269.3	252.2	16	1	111	104	1.65
	1975	55	211.9	208.0	13	0	112	101	1.62

*Do not use as annual statistics representative of air quality for that year because four valid quarters not available.

+Standard Geometric Deviation.

> represents greater than

SUSPENDED PARTICULATES - 24 HOUR SAMPLES (CONTINUED)
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	No. of Samples >24 Hr. Std.		Arith. Mean	Geo. Mean	SGD+
					Secondary	Primary			
Cedar Rapids									
Linn County	1973	32	446.1	344.5	14	4	170	152	1.60
Health Dept.	1974*	15	248.7	175.7	4	0	130	123	1.42
	1975	45	314.8	305.0	14	3	139	126	1.54
Cedar Rapids									
28th St. & 1st	1974*	34	324.4	236.4	6	1	114	104	1.72
Ave. N.E.	1975*	14	282.0	207.5	6	1	143	131	1.59
Cedar Rapids									
City Garages	1970	23	238.0	-	-	0	117	111	1.45
(EPA)	1971*	22	154.0	-	-	0	103	100	1.34
	1972	30	253.0	203.0	5	0	110	102	1.48
	1973*	4	102.0	60.0	0	0	64	59	1.51
	1974	23	278.0	232.0	4	1	101	85	1.80
	1975	33	162.0	161.0	2	0	93	87	1.45
Central City	1973*	10	160.7	118.7	1	0	96	91	1.38
	1974*	13	236.0	149.5	1	0	80	58	2.35
	1975*	15	313.1	139.2	1	1	94	77	1.75
Mt. Vernon	1973*	10	96.3	81.7	0	0	68	67	1.24
	1974*	13	162.9	129.5	1	0	65	53	1.94
	1975*	16	139.0	126.7	0	0	74	66	1.50

COEFFICIENT OF HAZE - 2 HOUR CONTINUOUS SAMPLES
(COHS/1000 Linear Feet)

Site Location	Year	No. of Samples	Max. 2 Hr.	2nd Max. 2 Hr.	Arith. Mean
Blackhawk County					
Waterloo					
Water Plant	1973*	730	1.00	0.74	0.142
	1974	3249	1.18	1.09	0.109
	1975	3360	0.87	0.74	0.111
Linn County					
Cedar Rapids					
City Garages	1973	2748	2.17	2.06	0.241
	1974	4003	3.79	2.22	0.221
	1975	4099	4.12	4.04	0.278

*Do not use as annual statistics representative of air quality for that year because four valid quarters not available.

+Standard Geometric Deviation.

> represents greater than

COEFFICIENT OF HAZE - 2 HOUR CONTINUOUS SAMPLES (CONTINUED)
(COHS/1000 Linear Feet)

Site Location	Year	No. of Samples	Max. 2 Hr.	2nd Max. 2 Hr.	Arith. Mean
Cedar Rapids					
Linn County Health	1973*	2086	1.34	1.28	0.183
Department	1975*	2701	1.19	1.10	0.167
Cedar Rapids					
28th Street &	1974*	2172	2.63	1.37	0.262
1st Avenue NE	1975*	1029	1.28	1.10	0.269

SULFUR DIOXIDE - 24 HOUR SAMPLES
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	No. of Samples >24 Hr. Std.	Arith. Mean
Blackhawk County						
Waterloo						
Water Plant	1973*	40	79.3	38.2	0	4.9
	1974	59	93.8	92.5	0	15.3
	1975	59	31.0	27.1	0	5.5

SULFUR DIOXIDE - 1 HOUR CONTINUOUS SAMPLES
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 3 Hr.	2nd Max. 3 Hr.	No. of Samples >3 Hr. Std.	Max. 24 Hr.	2nd Max. 24 Hr.	No. of Samples >24 Hr. Std.	Arith. Mean
Linn County									
Cedar Rapids									
City Garages	1974	8318	572	469	0	232	214	0	54
	1975	8431	657	603	0	230	222	0	46
Cedar Rapids									
Linn County	1973*	3877	-	-	0	288	259	0	42
Health Dept.	1975*	7207	467	357	0	183	173	0	42
Cedar Rapids									
28th St. &	1974*	4356	336	220	0	165	128	0	28
1st Ave. NE	1975*	2078	535	518	0	139	102	0	35

*Do not use as annual statistics representative of air quality for that year because four valid quarters not available.

> represents greater than

NITROGEN DIOXIDE - 24 HOUR SAMPLES
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	Violation of Standards	Arith. Mean
Linn County						
Cedar Rapids Noelridge Park	1974*	8	31.7	29.3	No	19.9
	1975*	15	49.0	33.8	No	22.7
Cedar Rapids City Garages	1975*	13	51.8	51.7	No	35.4
Cedar Rapids Jane Boyd Comm. Center	1974*	8	43.5	29.1	No	27.3
	1975*	7	43.5	43.3	No	32.0
Cedar Rapids Linn County Health Dept.	1974*	5	34.3	23.1	No	19.8
	1975*	14	71.5	56.9	No	32.7
Cedar Rapids 28th St. & 1st Ave. NE	1974*	9	62.0	47.2	No	36.1
	1975*	5	34.2	30.4	No	27.0

CARBON MONOXIDE - 1 HOUR CONTINUOUS SAMPLES
(Parts Per Million)

Site Location	Year	No. of Samples	Max. 1 Hr.	2nd Max. 1 Hr.	No. of Samples >1 Hr. Std.	Max. 8 Hr.	2nd Max. 8 Hr.	No. of Samples >8 Hr. Std.	Arith. Mean
Linn County									
Cedar Rapids Linn County Health Dept.	1973*	2252	10.0	10.0	0	9.1	6.7	1	2.30
	1974*	1555	20.0	16.0	0	9.0	8.6	0	2.23
	1975	7260	18.0	17.0	0	10.7	9.6	14	3.56

*Do not use as annual statistics representative of air quality for that year because four valid quarters not available.

> represents greater than

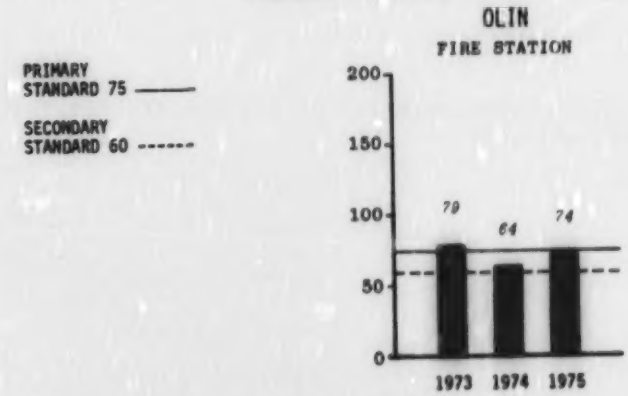
OZONE - 1 HOUR CONTINUOUS SAMPLES (Micrograms Per Cubic Meter)						
Site Location	Year	No. of Samples	Max. 1 Hr.	2nd Max. 1 Hr.	No. of Samples >1 Hr. Std.	Arith. Mean
Linn County						
Cedar Rapids Linn County Health Dept.	1975*	6297	160	160	0	40
Cedar Rapids 28th St. & 1st. Ave. NE	1974*	4001	200	200	10	28
	1975*	2123	130	100	0	30

TOTAL HYDROCARBONS - 1 HOUR CONTINUOUS SAMPLES (Micrograms Per Cubic Meter)						
Site Location	Year	No. of Samples	Max. 3 Hr. (6-9 a.m.)	2nd Max. 3 Hr. (6-9 a.m.)	No. of Samples >3 Hr. Std.	Arith. Mean
Linn County						
Cedar Rapids Linn County Health Dept.	1975*	4260	980	880	86	164
Cedar Rapids 28th Street & 1st Ave. NE	1974*	665	1867	1280	42	294
	1975*	1975	913	833	60	271

*Do not use as annual statistics representative of air quality for that year because four valid quarters not available.

> represents greater than

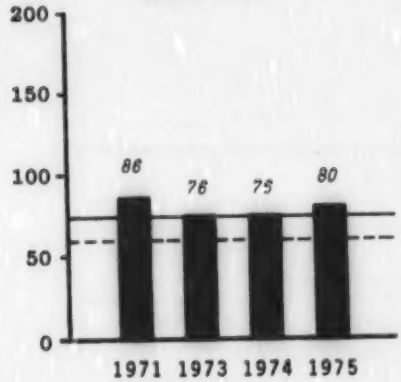
GRAPHICAL TRENDS OF ANNUAL GEOMETRIC MEANS OF SUSPENDED PARTICULATES
MICROGRAMS PER CUBIC METER



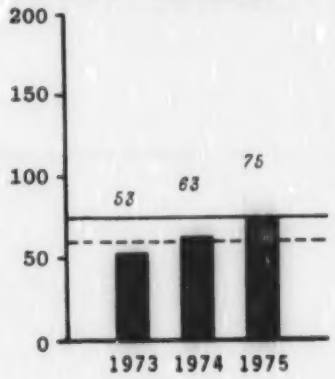
GRAPHICAL TRENDS OF ANNUAL GEOMETRIC MEANS OF SUSPENDED PARTICULATES
MICROGRAMS PER CUBIC METER

PRIMARY STANDARD 75 ——— SECONDARY STANDARD 60 ------

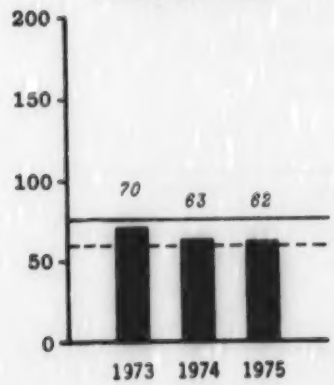
WATERLOO
WATER PLANT



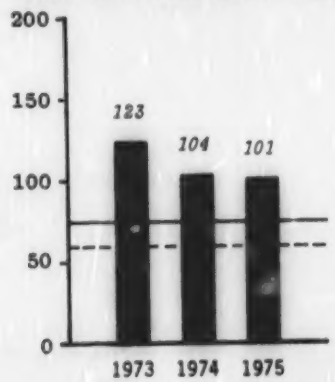
WATERLOO
316 E. 5TH STREET



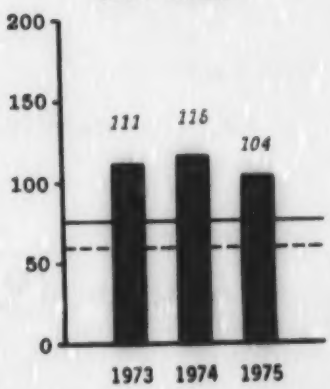
CEDAR RAPIDS
NOELRIDGE PARK



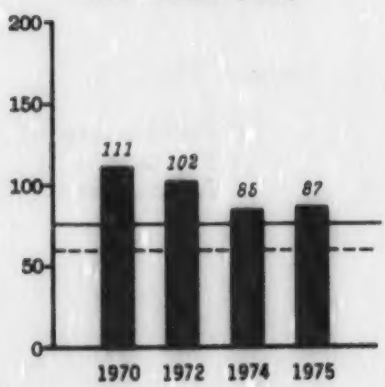
CEDAR RAPIDS
JANE BOYD COMMUNITY CENTER



CEDAR RAPIDS
CITY GARAGE

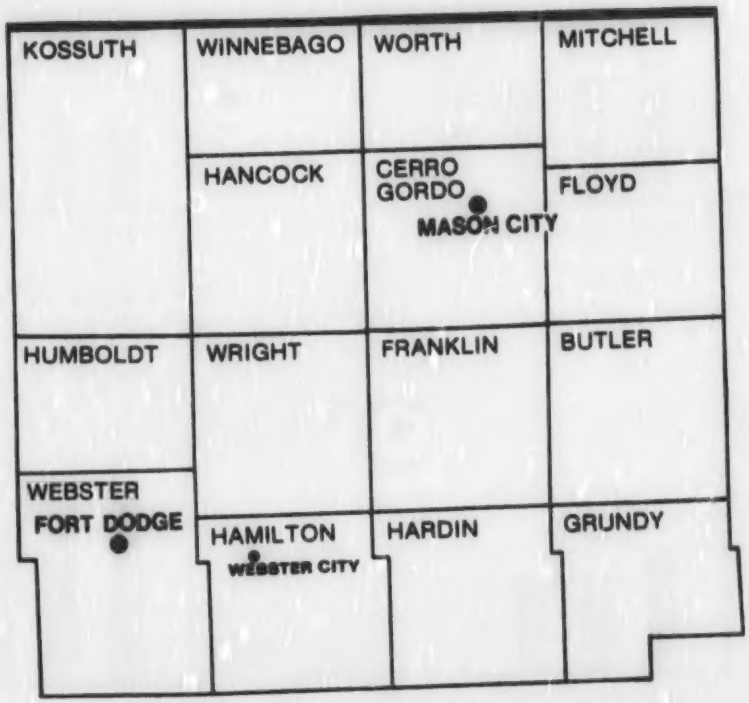


CEDAR RAPIDS
CITY GARAGE (EPA)



AQCR 089

NORTHCENTRAL IOWA INTRASTATE



Mason City

2 Particulate Hi-Volume
1 SO_2 Bubbler
1 Particulate - Tape

Fort Dodge

1 Particulate Hi-Volume

Webster City

1 Particulate Hi-Volume

AQCR 089 NORTH CENTRAL INTRASTATE REGION

Site Location	Address	Agency	Equipment	Environment
Cerro Gordo County				
Mason City Water Plant	339 - 13th St. NE	SHL	Hi-Vol Tape Sampler SO_2 - Bubbler	Industrial
Mason City Water Tower	14th & S. Kentucky Ave.	SHL	Hi-Vol	Residential
Hamilton County				
Webster City T. Loring Farm	Rural Route	SHL	Hi-Vol	Rural
Webster County				
Fort Dodge Municipal Water Plant	Phinney Park Drive	SHL	Hi-Vol	Industrial

SUSPENDED PARTICULATES - 24 HOUR SAMPLES
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	No. of Samples >24 Hr. Std.		Arith. Mean	Geo. Mean	SGD+
					Secondary	Primary			
Cerro Gordo County									
Mason City Water Plant	1970*	20	229.0	219.0	6	0	115	101	1.69
	1971	36	705.0	479.0	15	3	152	119	2.01
	1972	55	598.0	562.0	16	8	167	131	1.99
	1973	39	882.0	502.0	17	8	161	118	2.12
	1974	58	430.0	374.0	25	11	158	123	2.04
	1975	58	348.0	294.0	13	2	113	98	1.71
Mason City Water Tower	1973	43	231.0	218.0	4	0	88	76	1.72
	1974	62	257.0	210.0	6	0	86	74	1.77
	1975	57	292.0	254.0	3	1	71	62	1.64
Hamilton County									
Webster City T. Loring Farm	1973	45	168.0	160.0	3	0	75	64	1.79
	1974	61	359.0	311.0	10	4	82	58	2.32
	1975	54	242.0	187.0	3	0	60	48	1.90
Webster County									
Fort Dodge Municipal Water Plant	1973	43	139.8	111.3	0	0	58	52	1.59
	1974	57	141.0	132.0	0	0	57	51	1.65
	1975	59	360.0	138.0	1	1	53	42	1.92

*Do not use as annual statistics representative of air quality for that year because four valid quarters not available.

+Standard Geometric Deviation.

represents greater than

COEFFICIENT OF HAZE - 2 HOUR CONTINUOUS SAMPLES (COHS/1000 Linear Feet)					
Site Location	Year	No. of Samples	Max. 2 Hr.	2nd Max 2 Hr.	Arith. Mean
Cerro Gordo County					
Mason City Water Plant	1973*	1277	1.52	1.36	0.177
	1974	2461	1.18	0.65	0.088
	1975	1664	1.40	1.40	0.099

SULFUR DIOXIDE - 24 HOUR SAMPLES (Micrograms Per Cubic Meter)						
Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	No. of Samples >24 Hr. Std.	Arith. Mean
Cerro Gordo County						
Mason City Water Plant	1973*	40	109.0	83.8	0	6.8
	1974	59	362.0	272.0	0	25.7
	1975	51	622.0	291.0	1	30.5

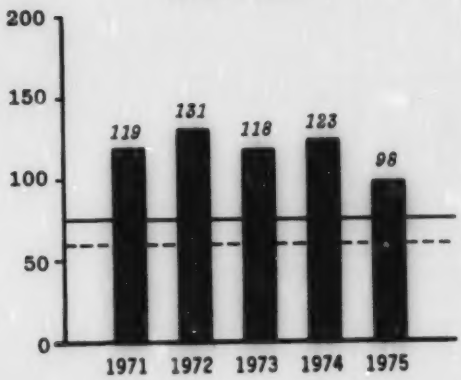
*Do not use as annual statistics representative of air quality for that year because four valid quarters not available.

` represents greater than

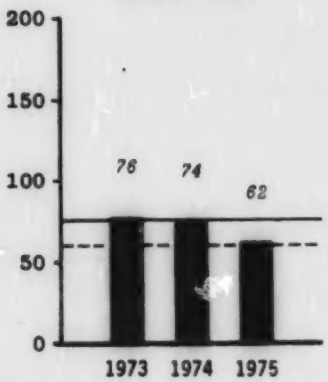
GRAPHICAL TRENDS OF ANNUAL GEOMETRIC MEANS OF SUSPENDED PARTICULATES
MICROGRAMS PER CUBIC METER

PRIMARY STANDARD 75 ——— SECONDARY STANDARD 60 ------

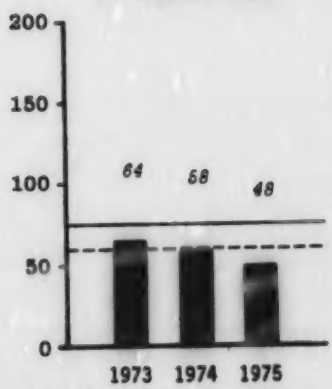
MASON CITY
WATER PLANT



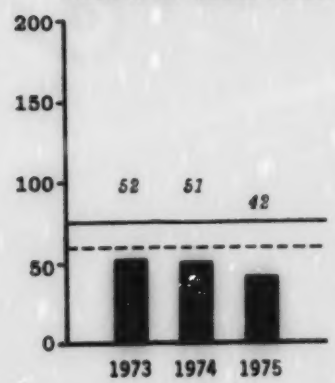
MASON CITY
WATER TOWER



WEBSTER CITY
T. LORING FARM

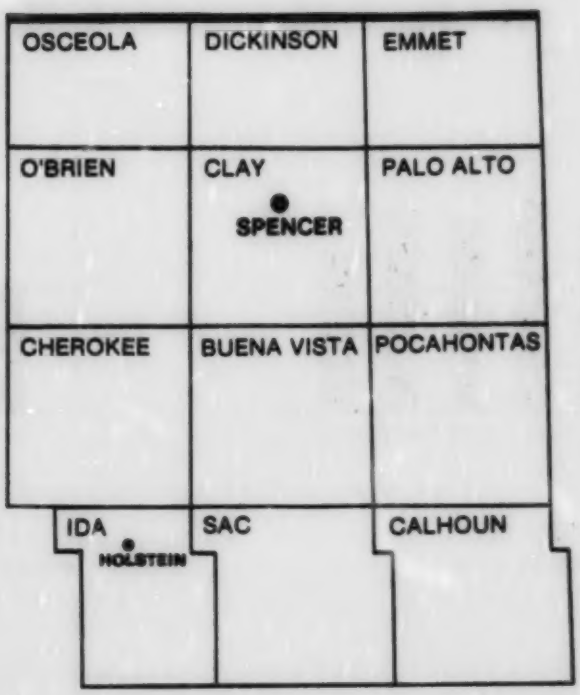


FORT DODGE
MUNICIPAL WATER PLANT



AQCR 090

NORTHWEST IOWA INTRASTATE



Spencer

1 Particulate Hi-Volume
1 SO_2 Bubbler

Holstein

1 Particulate Hi-Volume

AQCR 090 NORTHWEST IOWA INTRASTATE REGION

Site Location	Address	Agency	Equipment	Environment
Clay County				
Spencer Hospital	1st Ave. E & 11th St.	SHL	Hi-Vol SO_2 - Bubbler	Residential
Ida County				
Holstein City Center	510 Merkley	SHL	Hi-Vol	Residential

SUSPENDED PARTICULATES - 24 HOUR SAMPLES
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	No. of Samples >24 Hr. Std.		Arith. Mean	Geo. Mean	SGD+
					Secondary	Primary			
Clay County									
Spencer Hospital	1973	43	251.0	161.0	2	0	80	68	1.78
	1974	59	220.0	166.0	4	0	71	60	1.83
	1975	61	311.0	210.0	4	1	70	58	1.87
Ida County									
Holstein 510 Merkley	1973	41	224.0	180.7	5	0	84	70	1.93
	1974	35	155.0	155.0	2	0	82	73	1.85
	1975	34	115.0	109.0	0	0	45	39	1.74

SULFUR DIOXIDE - 24 HOUR SAMPLES
(Micrograms Per Cubic Meter)

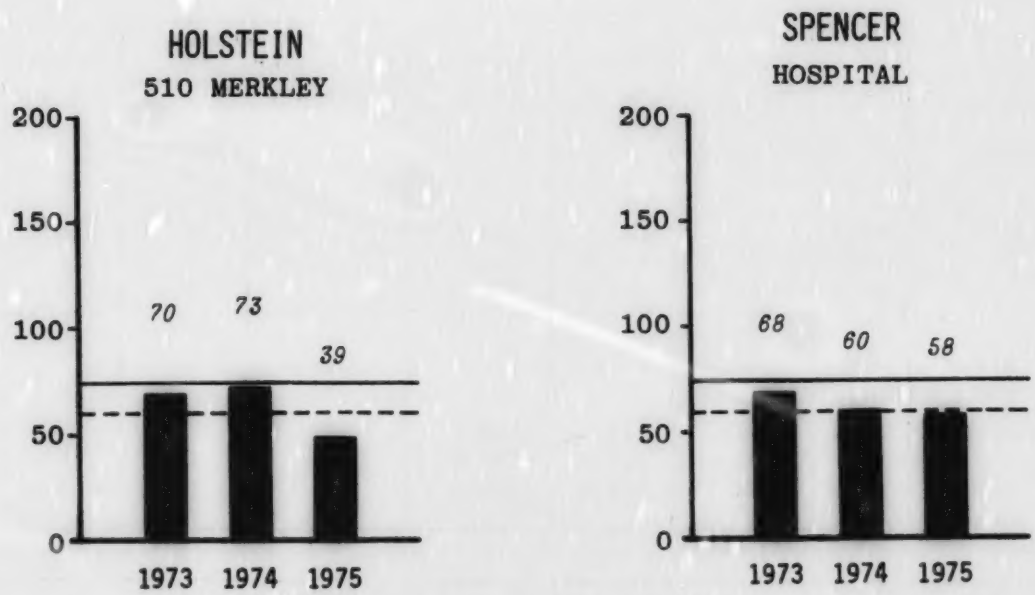
Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	No. of Samples >24 Hr. Std.	Arith. Mean
Clay County						
Spencer Hospital	1973*	22	0.0	0.0	0	0.0
	1974	60	25.7	12.5	0	4.8
	1975	58	12.5	12.5	0	5.8

*Do not use as annual statistics representative of air quality for that year because four valid quarters not available.

+Standard Geometric Deviation.
represents greater than

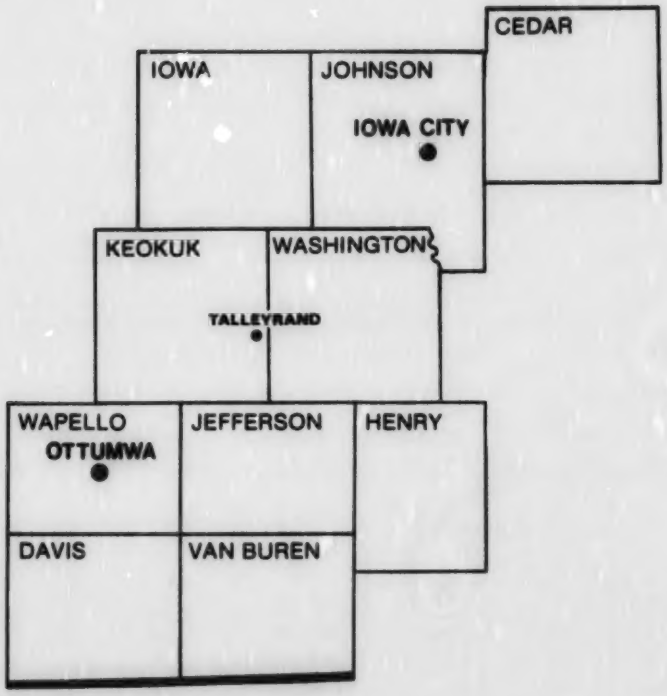
GRAPHICAL TRENDS OF ANNUAL GEOMETRIC MEANS OF SUSPENDED PARTICULATES
MICROGRAMS PER CUBIC METER

PRIMARY STANDARD 75 ——— SECONDARY STANDARD 60 ------



AQCR 091

SOUTHEAST IOWA INTRASTATE



Iowa City

1 Particulate Hi-Volume
1 SO_2 Bubbler

Talleyrand

1 Particulate Hi-Volume

Ottumwa

1 Particulate Hi-Volume
1 SO_2 Bubbler

AQCR 091 SOUTHEAST IOWA INTRASTATE REGION

Site Location	Address	Agency	Equipment	Environment
Johnson County				
Iowa City Medical Lab. Bldg.	University of Iowa	SHL	Hi-Vol SO_2 - Bubbler	Commercial
Keokuk County				
Talleyrand Cochran Farm	Rural Route	SHL	Hi-Vol	Rural
Wapello County				
Ottumwa City Hall	Fourth & Market Sts.	SHL	Hi-Vol SO_2 - Bubbler	Commercial

SUSPENDED PARTICULATES - 24 HOUR SAMPLES
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	No. of Samples >24 Hr. Std. Secondary	No. of Samples >24 Hr. Std. Primary	Arith. Mean	Geo. Mean	SGD+
Johnson County									
Iowa City Medical Lab. Building	1971*	9	154.0	84.0	1	0	63	54	1.81
	1972	54	388.0	323.0	4	2	97	87	1.53
	1973	46	480.0	194.0	5	1	96	81	1.76
	1974	60	151.0	130.0	1	0	65	57	1.70
	1975	58	140.0	134.0	0	0	72	66	1.51
Keokuk County									
Talleyrand Cochran Farm	1973	46	296.9	198.2	2	1	56	46	1.96
	1974	59	193.0	193.0	8	0	82	68	1.90
	1975	56	214.0	175.0	2	0	56	47	1.82
Wapello County									
Ottumwa City Hall	1974*	44	313.0	210.0	3	1	91	79	1.73
	1975	59	188.0	160.0	4	0	87	78	1.60

*Do not use as annual statistics representative of air quality for that year because four valid quarters not available.

+Standard Geometric Deviation.

> represents greater than

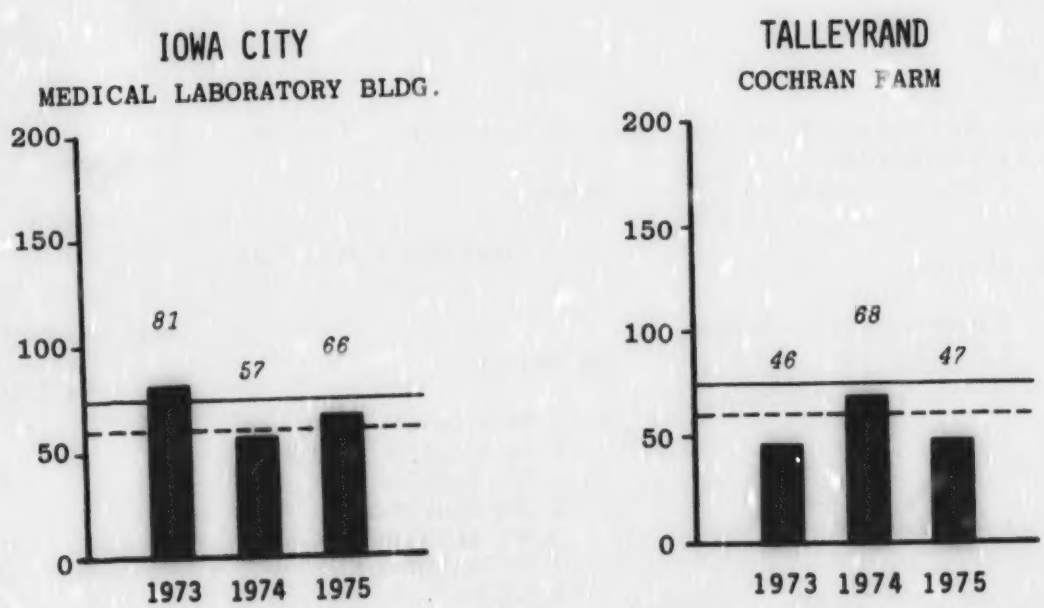
SULFUR DIOXIDE - 24 HOUR SAMPLES (Micrograms Per Cubic Meter)						
Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	No. of Samples >24 Hr. Std.	Arith. Mean
Johnson County						
Iowa City Medical Lab. Building	1973*	42	134.6	94.2	0	9.5
	1974	58	212.0	123.0	0	13.7
	1975	57	53.0	47.4	0	11.4
Wapello County						
Ottumwa City Hall	1974*	17	20.6	12.5	0	5.6
	1975	53	12.5	12.5	0	4.5

*Do not use as annual statistics representative of air quality for that year because four valid quarters not available.

> represents greater than

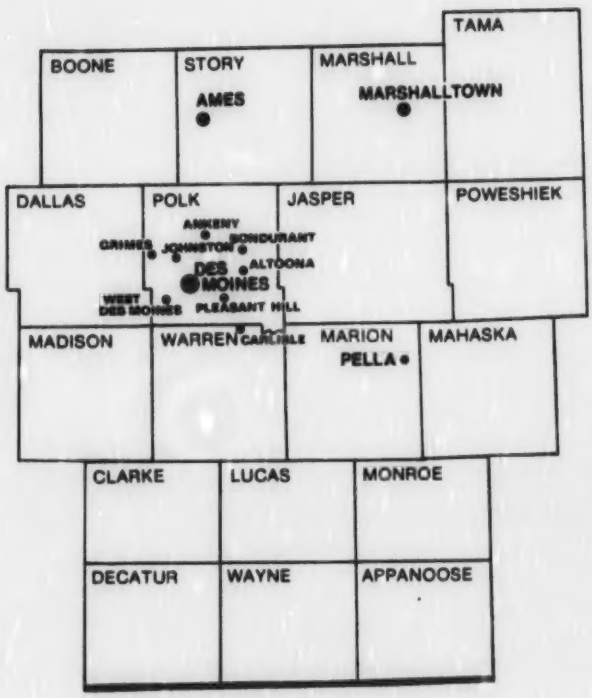
GRAPHICAL TRENDS OF ANNUAL GEOMETRIC MEANS OF SUSPENDED PARTICULATES
MICROGRAMS PER CUBIC METER

PRIMARY STANDARD 75 ——— SECONDARY STANDARD 60 ------



AQCR 092

SOUTHCENTRAL IOWA INTRASTATE



Ames

1 Particulate Hi-Volume
1 SO_2 Bubbler
1 SO_2 Continuous

Marshalltown

1 Particulate Hi-Volume
1 Particulate - Tape

Pella

1 SO_2 Bubbler

Altoona

1 Particulate Hi-Volume

Ankeny

1 Particulate Hi-Volume

Des Moines

7 Particulate Hi-Volume
2 Particulate - Tape
6 SO_2 Bubbler
2 SO_2 Continuous
5 NO_x Bubbler
1 CO Continuous
1 Ozone

Grimes

1 Particulate Hi-Volur

Johnston

1 Particulate Hi-Volur

Pleasant Hill

1 Particulate Hi-Volur
1 SO_2 Bubbler
1 NO_x Bubbler

Carlisle

1 SO_2 Continuous

Bondurant

1 Ozone

West Des Moines

1 Particulate Hi-Volur

AQCR 092 - SOUTHCENTRAL IOWA INTRASTATE REGION

Site Location	Address	Agency	Equipment	Environment
Marion County				
Pella Pella D.X. Station	414 Oskaloosa St.	SHL	SO_2 Bubbler	Industrial
Marshall County				
Marshalltown Water Plant	911 N. Center St.	SHL	Hi-Vol Tape Sampler	Residential
Polk County				
Altoona Water Works Bldg.	105 - 3rd St.	DMPC	Hi-Vol	Residential
Ankeny Water Works Garage	408 - 3rd St.	DMPC	Hi-Vol	Commercial
Des Moines Fire Station #1	9th & Mulberry	DMPC EPA EPA EPA	Hi-Vol Hi-Vol SO_2 Bubbler NO_2 Bubbler	Commercial
Des Moines Fire Station #17	2217 Beaver	DMPC	Hi-Vol	Residential
Des Moines Fire Station #16	1249 McKinley	DMPC	Hi-Vol	Residential
Des Moines Bankers Trust	6th & Locust	DMPC	CO Continuous	Commercial
Des Moines Smith-Voorhees	1040 Fifth Ave.	DMPC	Tape Sampler SO_2 Bubbler NO_2 Bubbler	Commercial
Des Moines Iowa Police Radio Station	5912 Second Ave.	DMPC	Ozone	Residential
Des Moines Industrial Park	5299 N.E. 15th	DMPC	Hi-Vol	Commerical
Des Moines Shell Oil Bldg.	302 S.E. 18th St.	DMPC	Hi-Vol SO_2 Bubbler NO_2 Bubbler	Industrial

Site Location	Address	Agency	Equipment	Environment
Des Moines Trailer	Fairgrounds	SHL	SO_2 Continuous	Residential
Des Moines Trailer	E. 18th and Dean	SHL	SO_2 Continuous	Commercial
Des Moines State Hygienic Lab	E. 7th & Court	SHL	Hi-Vol Tape Sampler SO_2 Bubbler	Commercial
Des Moines Preston Farm	5402 S.E. 52nd St.	DMPC	SO_2 Bubbler NO_2 Bubbler	Rural
Des Moines Greenwood Park	48th & Grand	DMPC	SO_2 Bubbler NO_2 Bubbler	Residential
Carlisle Water Lift Station	S.E. Avon Drive	SHL	SO_2 Continuous	Commerical
Grimes Fire Station	404 S. 2nd St.	DMPC	Hi-Vol	Commercial
Pleasant Hill Sewage Treatment Plant	5440 Vandalia Road	DMPC	Hi-Vol SO_2 Bubbler NO_2 Bubbler	Rural
Johnston Garden Club	5560 Merle Hay Road	DMPC	Hi-Vol	Residential
Boundurant Farrar School	Highway 64	DMPC	Ozone	Residential
West Des Moines Crestview Acres	916 Ashworth	DMPC	Hi-Vol	Residential
Story County				
Ames Fire Extension Bldg.	Iowa State University	SHL	Hi-Vol SO_2 Bubbler	Residential
Greenhouse	505 S. Maple	SHL	SO_2 Continuous	Residential

SUSPENDED PARTICULATES - 24 HOUR SAMPLES
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	No. of Samples >24 Hr. Std. Secondary	No. of Samples >24 Hr. Std. Primary	Arith. Mean	Geo. Mean	SGD+
Marshall County									
Marshalltown Water Plant	1973	59	269.0	224.0	6	1	79	65	1.85
	1974	60	397.0	371.0	10	3	104	84	1.86
	1975	59	401.0	172.0	4	1	87	74	1.73
Polk County									
Altoona Water Works Bldg.	1973	60	311.0	260.4	9	2	95	79	1.80
	1974	61	212.6	167.2	3	0	79	72	1.58
	1975	60	235.0	169.1	3	0	79	70	1.66
Ankeny Water Works Garage	1973	58	168.9	159.8	3	0	83	74	1.62
	1974	61	179.9	176.8	8	0	86	78	1.61
	1975	57	245.8	226.3	6	0	91	79	1.73
Des Moines Fire Station #1 (DMPC)	1969*	19	257.9	247.0	8	0	147	138	1.50
	1970	25	279.9	268.0	13	2	153	140	1.60
	1971	26	266.2	248.9	12	1	136	124	1.56
	1972	57	299.6	227.3	12	1	102	89	1.73
	1973	58	479.7	424.1	13	3	121	102	1.78
	1974	61	540.2	231.7	11	1	108	99	1.63
	1975	60	242.5	216.2	10	0	108	96	1.64
Des Moines Fire Station #1 (EPA)	1957	26	458.0	-	-	-	176	160	1.53
	1958	26	360.0	-	-	-	165	152	1.50
	1959	25	462.0	-	-	-	174	159	1.55
	1960	25	329.0	-	-	-	183	164	1.63
	1961	24	392.0	-	-	-	130	119	1.50
	1962	26	291.0	-	-	-	128	116	1.58
	1963	25	351.0	-	-	-	127	110	1.71
	1964	25	299.0	-	-	-	128	117	1.55
	1965	25	313.0	-	-	-	142	127	1.60
	1966	25	242.0	-	-	-	123	114	1.51
	1967	25	258.0	-	-	-	117	108	1.47
	1968	16	240.0	-	-	-	100	90	1.60
	1969	25	214.0	201.0	5	0	103	91	1.67

* Do not use as an annual statistic representative of air quality for that year because four valid quarters are not available.

+ Standard Geometric Deviation

represents greater than

SUSPENDED PARTICULATES - 24 HOUR SAMPLES (CONTINUED)
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	No of Samples >24 Hr. Std.		Arith. Mean	Geo. Mean	SGD+
					Secondary	Primary			
Polk County									
Des Moines Fire Station #1 (EPA) (Cont.)	1970	24	193.0	172.0	4	0	102	94	1.51
	1971	26	255.0	147.0	1	0	98	86	1.85
	1972	28	202.0	159.0	2	0	92	85	1.48
	1973*	3	108.0	56.0	0	0	67	61	1.55
	1974	29	367.0	166.0	2		89	75	1.76
	1975	36	181.0	159.0	2	0	71	63	1.64
Des Moines Fire Station #17	1969*	19	149.1	146.5	0	0	86	78	1.60
	1970	22	176.4	140.9	1	0	93	88	1.38
	1971	23	266.9	219.7	3	1	109	98	1.51
	1972	57	148.8	122.8	0	0	74	69	1.44
	1973	62	618.8	198.2	5	1	95	81	1.64
	1974	58	194.2	143.0	1	0	74	69	1.52
	1975	57	164.7	155.5	2	0	84	78	1.46
Des Moines Fire Station #16	1973	61	188.2	186.2	3	0	81	73	1.60
	1974	60	179.6	167.0	2	0	71	65	1.54
	1975	60	194.4	156.8	2	0	83	74	1.65
Des Moines Industrial Park	1969*	4	152.5	123.1	1	0	111	106	1.41
	1970	26	291.0	208.9	5	1	105	90	1.72
	1971	35	227.9	220.9	10	0	113	95	1.74
	1972	57	301.6	290.3	10	2	97	82	2.02
	1973	58	265.7	258.0	12	1	98	82	1.81
	1974	60	833.5	666.7	18	6	140	106	2.03
	1975	59	728.3	615.5	19	10	163	115	2.20
Des Moines 302 S.E. 18th St.	1972*	35	283.6	249.3	7	1	115	102	1.64
	1973	58	324.5	243.6	13	1	111	97	1.69
	1974	62	413.4	379.1	21	10	145	121	1.86
	1975	57	326.8	288.2	17	4	129	110	1.80
Des Moines State Hygienic Lab	1971*	15	182.0	-	-	-	68	62	2.00
	1972	44	161.0	160.0	2	0	74	65	1.79
	1973	62	211.0	204.0	7	0	84	69	1.99
	1974	60	206.0	178.0	4	0	80	70	1.78
	1975	57	233.0	192.0	4	0	84	73	1.74

* Do not use as an annual statistic representative of air quality for that year because four valid quarters are not available.

+ Standard Geometric Deviation

> represents greater than

SUSPENDED PARTICULATES - 24 HOUR SAMPLES (CONTINUED)
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	No. of Samples >24 Hr. Std.		Arith Mean	Geo. Mean	SGD+
					Secondary	Primary			
Polk County									
Grimes Fire Station	1973	59	291.0	281.2	10	2	98	81	1.85
	1974	61	308.6	172.4	6	1	91	80	1.63
	1975	59	280.4	200.7	12	1	98	83	1.83
Pleasant Hill Sewage Treatment Plant	1973	61	191.8	189.7	2	0	70	61	1.70
	1974	58	180.3	163.2	2	0	60	55	1.55
	1975	60	146.6	139.1	0	0	58	51	1.68
Johnston Garden Club	1973	61	972.2	464.4	5	3	97	70	2.00
	1974	60	522.3	467.9	8	4	101	77	1.99
	1975	60	295.5	226.9	5	1	79	66	1.80
West Des Moines Crestview Acres	1969*	19	231.0	155.7	3	0	105	90	1.88
	1970	24	217.9	170.0	4	0	102	89	1.84
	1971	23	243.4	207.5	4	0	99	90	1.74
	1972	56	196.2	194.4	2	0	70	58	1.67
	1973	61	292.5	240.1	4	1	78	68	1.65
	1974	59	296.1	201.0	4	1	79	70	1.64
	1975	60	156.8	149.1	1	0	71	63	1.69
Story County									
Ames Fire Extension Bldg.	1973*	8	51.4	35.1	0	0	28	26	1.37
	1974	59	191.0	148.0	1	0	66	59	1.67
	1975	44	209.0	150.0	1	0	69	60	1.76

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+ Standard Geometric Deviation

> represents greater than

COEFFICIENT OF HAZE - 2 HOUR CONTINUOUS SAMPLES
(COHS/1000 Linear Feet)

Site Location	Year	No. of Samples	Max. 2 Hr.	2nd Max. 2 Hr.	Arith. Mean
Marshall County					
Marshalltown Water Plant	1973	2293	0.65	0.57	0.081
	1974	3579	0.82	0.82	0.085
	1975	3430	1.13	1.00	0.099
Polk County					
Des Moines Smith-Voorhees	1973*	317	2.60	2.40	0.180
	1974*	2047	1.30	1.00	0.183
	1975*	580	0.80	0.70	0.143
Des Moines State Hygienic Lab	1973	3304	1.00	0.87	0.107
	1974	3545	1.36	1.00	0.174
	1975	2876	1.00	0.95	0.126

SULFUR DIOXIDE - 24 HOUR SAMPLES
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	No. of Samples >24 Hr. Std.	Arith. Mean
Marion County						
Pella 414 Oskaloosa St.	1974*	9	59.1	12.5	0	10.7
	1975	45	12.5	12.5	0	8.3
Polk County						
Des Moines Fire Station #1 (EPA)	1961*	15	236.0	-	0	27.0
	1962	26	367.0	-	1	52.0
	1963	24	79.0	-	0	21.0
	1964	24	39.0	-	0	12.0
	1965	24	67.0	-	0	11.0
	1966	23	36.0	-	0	13.0

* Do not use as an annual statistic representative of air quality for that year because four valid quarters are not available.

> represents greater than

SULFUR DIOXIDE - 24 HOUR SAMPLES (CONTINUED)
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	No. of Samples >24 Hr. Std.	Arith. Mean
Polk County						
Des Moines Fire Station #1 (EPA) (Cont.)	1967	26	69.0	-	0	15.0
	1968	25	33.0	-	0	11.0
	1969	24	95.0	-	0	17.0
	1970	26	59.0	-	0	11.0
	1971	24	16.0	-	0	5.0
	1972*	15	28.0	-	0	7.0
	1973*	4	6.0	3.0	0	2.8
	1974	28	33.0	12.0	0	5.5
	1975	31	51.0	49.0	0	12.5
Des Moines Smith-Voorhees	1973*	20	99.8	99.8	0	37.0
	1974	45	36.9	26.9	0	12.8
	1975	60	27.6	18.6	0	3.5
Des Moines 302 S.E. 18th St.	1973*	20	114.4	104.0	0	37.1
	1974	45	41.2	30.9	0	12.4
	1975	60	30.4	22.1	0	4.0
Des Moines State Hygienic Lab	1973*	35	57.8	42.7	0	3.4
	1974	61	54.0	21.8	0	6.5
	1975	60	33.4	20.8	0	7.9
Des Moines Preston Farm	1973*	20	148.1	105.0	0	44.0
	1974	46	105.2	59.0	0	15.9
	1975	59	70.6	52.2	0	6.2
Des Moines Greenwood Park	1973*	20	103.4	100.2	0	39.7
	1974	47	33.3	27.6	0	10.1
	1975	49	25.1	21.9	0	2.7
Pleasant Hill Sewage Treatment Plant	1973*	21	112.3	101.9	0	37.1
	1974	46	34.4	30.1	0	11.2
	1975	59	132.5	31.2	0	5.9
Story County						
Ames Fire Extension Bldg.	1973*	7	222.0	104.7	0	49.0
	1974	56	70.6	20.5	0	4.8
	1975	42	24.4	12.5	0	5.0

* Do not use as an annual statistic representative of air quality for that year because four valid quarters are not available.

> represents greater than

SULFUR DIOXIDE - 1 HOUR CONTINUOUS SAMPLES
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 3 Hr.	2nd Max. 3 Hr.	No. of Samples >3 Hr. Std	Max. 24 Hr.	2nd Max 24 Hr.	No. of Samples >24 Hr. Std.	Arith. Mean
Polk County									
Des Moines Fairgrounds	1975*	2522	135.2	82.9	0	26.4	22.4	0	1.7
Des Moines E. 18th & Dean	1975*	3928	145.3	132.3	0	71.1	38.2	0	1.7
Carlisle Water Lift Station	1975*	3619	197.2	166.6	0	119.4	102.8	0	3.3
Story County									
Ames 505 S. Maple	1975*	491	290.0	263.8	0	140.3	20.3	0	8.0

NITROGEN DIOXIDE - 24 HOUR SAMPLES
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 24 H..	2nd Max. 24 Hr.	Violation of Annual Standard	Arith. Mean
Polk County						
Des Moines Fire Station #1 (EPA)	1967*	12	66.0	-	No	26.0
	1968	23	34.0	-	No	17.0
	1969	23	26.0	-	No	12.0
	1970*	7	13.0	-	No	10.0
	1973*	4	133.0	65.0	No	66.5
	1974	27	106.0	73.0	No	43.6
	1975	34	70.0	62.0	No	40.1
Des Moines Smith-Voorhees	1973*	33	201.7	188.4	No	90.8
	1974	61	141.9	130.7	No	47.5
	1975	60	79.5	77.4	No	39.5
Des Moines 302 S.E. 18th St.	1973*	32	144.2	143.2	No	70.2
	1974	61	152.8	119.4	No	32.5
	1975	60	49.1	47.1	No	21.2

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> represents greater than

NITROGEN DIOXIDE - 24 HOUR SAMPLES (CONTINUED)
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	Violation of Annual Standard	Arith. Mean
Des Moines Preston Farm (Continued)	1973*	26	244.4	138.5	No	76.2
	1974	58	124.1	124.1	No	22.9
	1975	59	36.0	30.1	No	11.1
Des Moines Greenwood Park	1973*	32	171.0	160.0	No	85.7
	1974	56	149.0	137.9	No	25.3
	1975	49	37.5	29.6	No	14.4
Pleasant Hill Sewage Treatment Plant	1973	33	248.3	139.0	No	58.7
	1974	56	139.0	129.1	No	23.6
	1975	58	38.8	36.8	No	14.0

CARBON MONOXIDE - 1 HOUR CONTINUOUS SAMPLES
(Parts Per Million)

Site Location	Year	No of Samples	Max. 1 Hr.	2nd Max. 1 Hr.	No. of Samples >1 Hr. Std.	Max. 8 Hr.	2nd Max 8 Hr.	No. of Samples >8 Hr. Std.	Arith. Mean
Polk County									
Des Moines Bankers Trust	1973*	4947	24.0	23.0	0	13.9	11.2	67	5.80
	1974	8049	29.0	26.0	0	16.3	15.1	32	2.42
	1975	7770	30.5	25.0	0	16.6	14.8	66	3.11

OZONE - 1 HOUR CONTINUOUS SAMPLES
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 1 Hr.	2nd Max. 1 Hr.	No. of Samples >1 Hr. Std.	Arith. Mean
Polk County						
Des Moines Iowa Police Radio Station	1971*	4017	210.0	200.0	16	-
	1972*	3120	160.0	160.0	0	-
	1973*	627	110.0	110.0	0	29.0
	1974	7065	160.0	160.0	0	36.6
	1975	7913	198.0	194.0	22	47.6
Boundurant Farrar School	1974*	2324	64.0	64.0	0	18.2
	1975	8491	200.0	200.0	127	55.6

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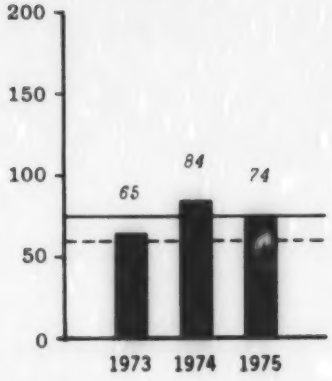
represents greater than

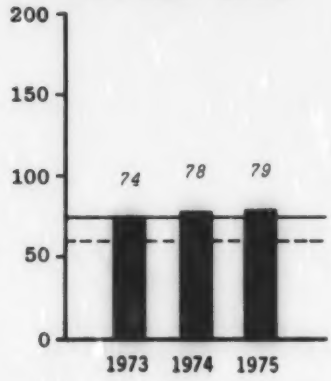
GRAPHICAL TRENDS OF ANNUAL GEOMETRIC MEANS OF SUSPENDED PARTICULATES
MICROGRAMS PER CUBIC METER

PRIMARY STANDARD 75 ——— SECONDARY STANDARD 60 ------

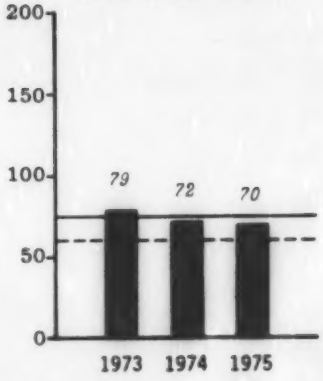
MARSHALLTOWN
WATER PLANT



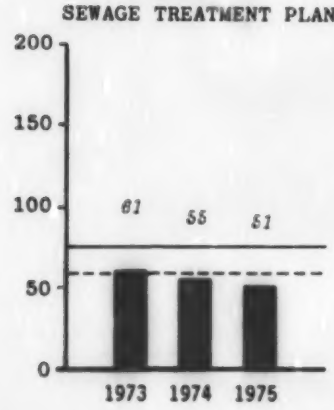
ANKENY
WATER WORKS GARAGE



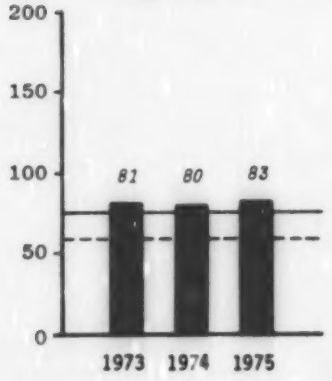
ALTOONA
WATER WORKS BLDG.



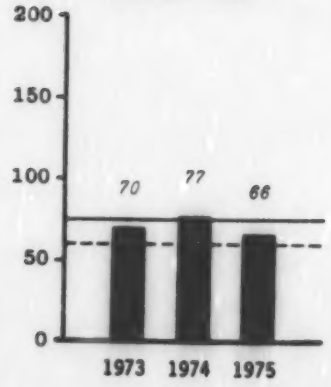
PLEASANT HILL
SEWAGE TREATMENT PLANT



GRIMES
FIRE STATION



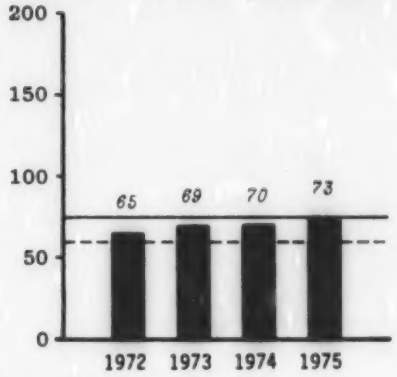
JOHNSTON
GARDEN CLUB



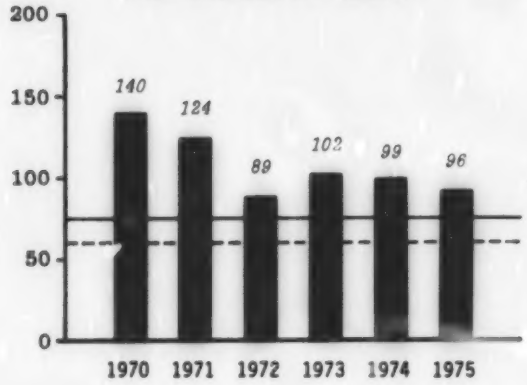
GRAPHICAL TRENDS OF ANNUAL GEOMETRIC MEANS OF SUSPENDED PARTICULATES
MICROGRAMS PER CUBIC METER

PRIMARY STANDARD 75 ——— SECONDARY STANDARD 60 ------

DES MOINES
STATE HYGIENIC LABORATORY



DES MOINES
FIRE STATION #1 (DMPC)



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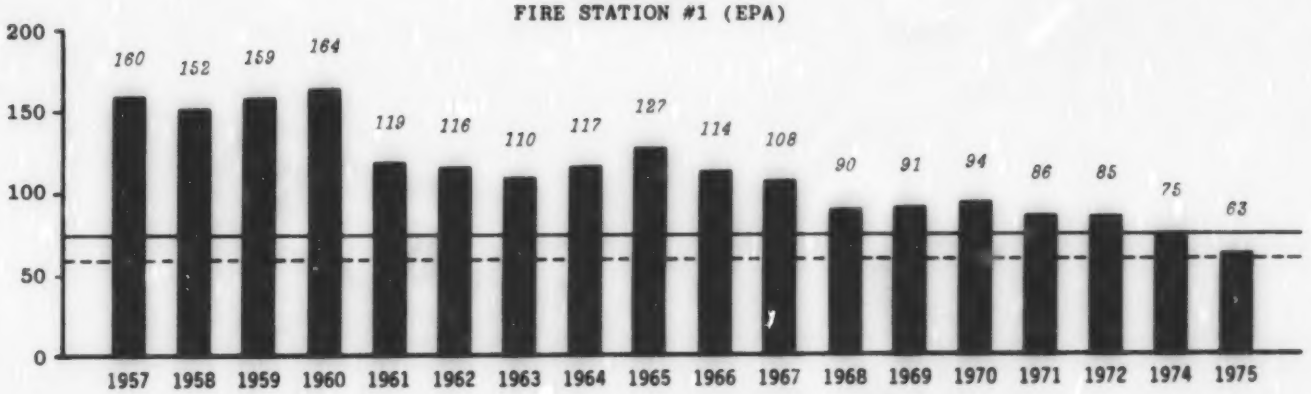

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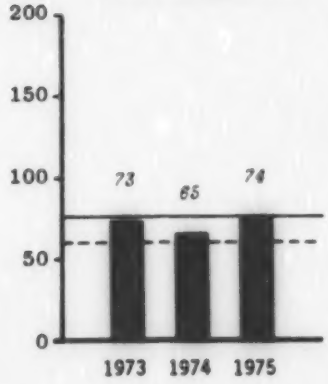
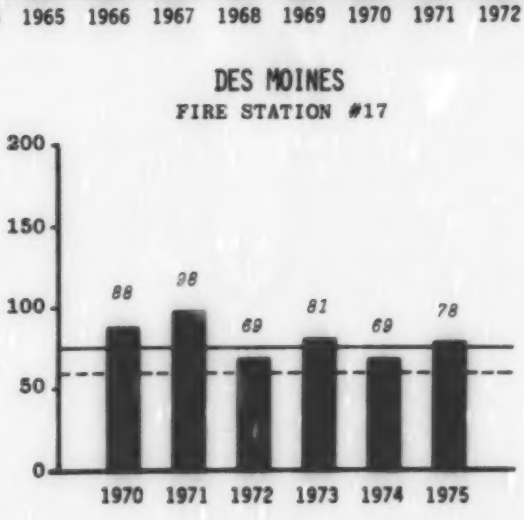
FIRE STATION #16



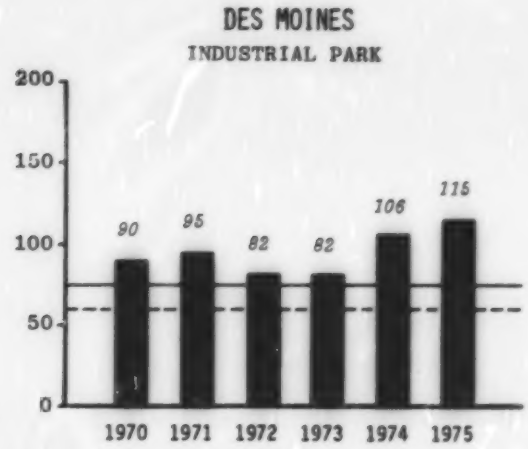
DES MOINES
FIRE STATION #17

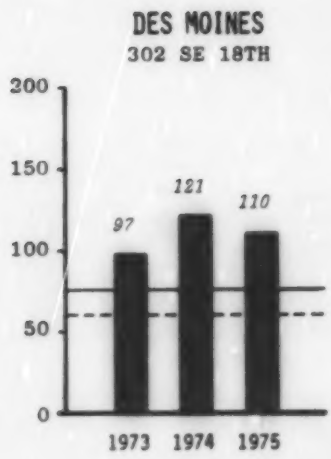


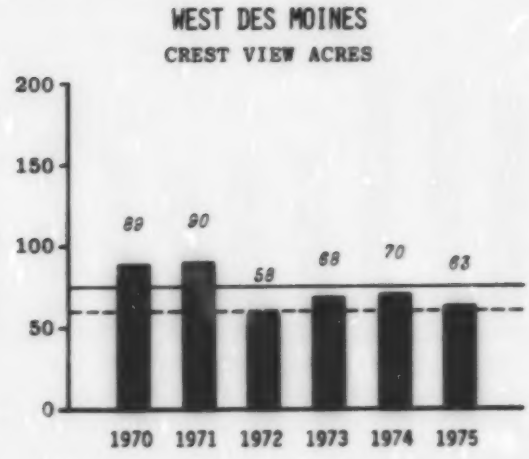
GRAPHICAL TRENDS OF ANNUAL GEOMETRIC MEANS OF SUSPENDED PARTICULATES
MICROGRAMS PER CUBIC METER

PRIMARY
STANDARD 75 ———

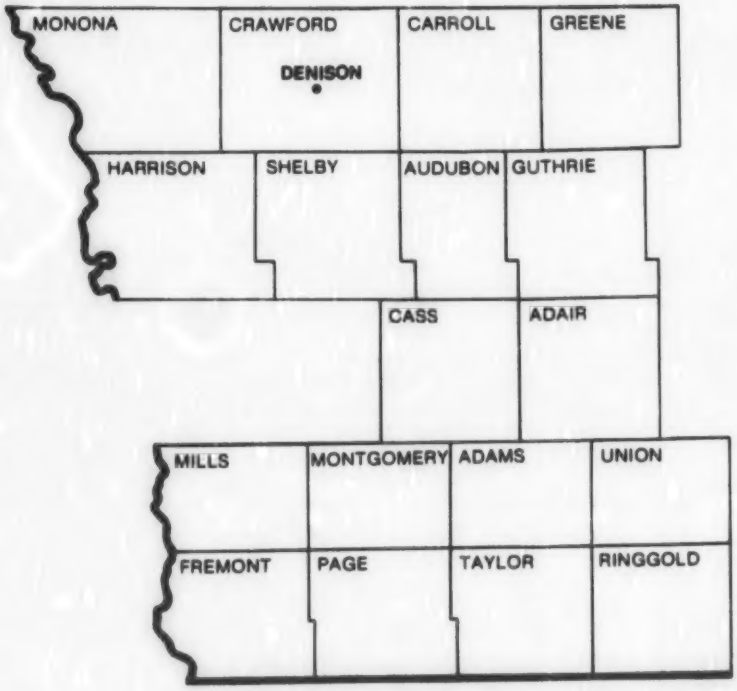
SECONDARY
STAMDARD 60 ------







AQCR 093
SOUTHWEST IOWA INTRASTATE



Denison

1 Particulate Hi-Volume
1 SO_2 Bubbler

Site Location	Address	Agency	Equipment	Environment
Crawford County				
Denison Municipal Water Plant	U.S. 59 & Ia. 141	SHL	Hi-Vol SO_2 - Bubbler	Rural

SUSPENDED PARTICULATES - 24 HOUR SAMPLES
(Micrograms Per Cubmic Meter)

Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	No. of Samples >24 Hr. Std.		Arith. Mean	Geo. Mean	SGD+
					Secondary	Primary			
Crawford County									
Denison Municipal Water Plant	1972*	6	48.0	44.0	0	0	35	34	1.29
	1973	43	198.0	193.0	2	0	82	73	1.66
	1974	58	311.0	284.0	5	2	75	58	2.10
	1975	56	153.0	148.0	1	0	66	56	1.80

SULFUR DIOXIDE - 24 HOUR SAMPLES
(Micrograms Per Cubic Meter)

Site Location	Year	No. of Samples	Max. 24 Hr.	2nd Max. 24 Hr.	No. of Samples >24 Hr. Std.	Arith. Mean
Crawford County						
Denison Municipal Water Plant	1973*	38	0.0	0.0	0	0.0
	1974	55	15.4	12.8	0	3.5
	1975	55	12.5	12.5	0	4.4

*Do not use as annual statistics representative of air quality for that year because four valid quarters not available.

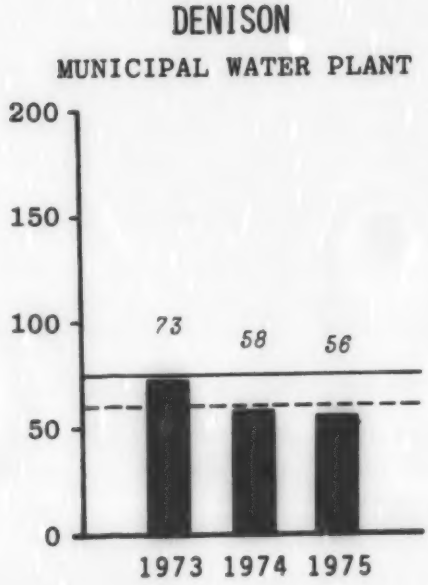
+Standard Geometric Deviation.

> represents greater than

GRAPHICAL TRENDS OF ANNUAL GEOMETRIC MEANS OF SUSPENDED PARTICULATES
MICROGRAMS PER CUBIC METER

PRIMARY
STANDARD 75 ———

SECONDARY
STANDARD 60 ------



V STATEWIDE DATA ANALYSIS AND TRENDS

Suspended Particulates

Suspended particulates showed the most significant decrease of any pollutant monitored in Iowa in 1975. A downward trend from 1974 in the annual geometric means occurred in thirty-one of the fifty Hi-Volume sampling sites. Eighteen of these thirty-one decreased by an amount greater than five micrograms per cubic meter. A downward trend was also observed in the number of secondary standard violations. Table II shows the trend between 1974 and 1975 for Hi-Volume sampling sites.

The downward trend in suspended particulates is believed to be the result of regulations requiring control devices to be installed on new or existing equipment exceeding the emission standards. Most industrial sources affected by these regulations were in compliance by July 1, 1975.

Statewide rankings of Hi-Volume samplers are displayed in Table III and Table IV. Table III ranks monitoring sites in order of annual geometric means while Table IV ranks the sites in order of standard violations.

Sulfur Dioxide

No monitoring sites in Iowa exceeded the three-hour, twenty-four hour, or annual standards for sulfur dioxide in 1975. For monitors having two valid years of data (1974 and 1975), comparisons are made. For 24-hour gas bubblers, annual arithmetic means decreased at eight sites, increased at eight sites, and one monitor showed no change. All eight monitors with higher means in 1975 increased by less than five micrograms per cubic meter and six of the eight increased by less than two micrograms per cubic meter. All continuous sulfur dioxide monitors showed decreases in annual arithmetic means.

Carbon Monoxide

Two of the three carbon monoxide analyzers in Iowa violated the eight-hour standard in 1975; however, no site exceeded the one-hour standard. The Des Moines carbon monoxide site exceeded the standards sixty-five times in 1975, and showed an increase in the arithemtic mean over the previous year. The Cedar Rapids location had fourteen violations in 1975. The third monitor, Dubuque, had one eight-hour violation for 1975. Available monitoring data indicate an increasing problem with carbon monoxide in certain Iowa locations.

Photochemical Oxidants

Iowa's first ozone advisories and alert occurred in the summer of 1975. Every site monitoring oxidants exceeded the 160 microgram per cubic meter standard at least once. Two sites exceeded the alert level of 200 micrograms per cubic meters. The Bondurant site recorded 23 days in 1975 that the ozone levels exceeded the air quality standards. This is the highest number of violations since ozone monitoring began. With the increase in hydrocarbon emissions because of increased vehicular traffic, it is possible that in the future the standard violations could surpass the excessive number of violations recorded in 1975.

Nitrogen Dioxide

There were no violations of the annual standards for nitrogen dioxide in 1975. All ten gas bubblers with a year's valid data showed a decrease in the annual arithmetic mean.

Hydrocarbons

Only one city in Iowa monitored hydrocarbons in 1975, with two sites recording data. Sixty violations of the 3-hour hydrocarbon standard were recorded for

a three month period at one Cedar Rapids site while eighty-six violations were recorded for the remaining nine months at the other Cedar Rapids site. Because hydrocarbons are a precursor to ozone formation, it will be necessary to expand the hydrocarbon monitoring network in the future. It is not known whether the hydrocarbon standards are being violated in other parts of Iowa; however, high ozone concentrations monitored at other locations may indicate a potential hydrocarbon problem in those areas.

TABLE II

Trend of Geometric Means From
Hi-Volume Samplers Operating in 1974 and 1975

Decreased (micrograms per cubic meter)					No Change	Increased (micrograms per cubic meter)			
Difference	>15	11-15	6-10	0-5	0	0-5	6-10	11-15	>15
Total Number of Monitors (50)	5	6	7	13	0	9	5	1	4
Total	31				0	19			

> represents greater than

TABLE III
RANKING OF HI-VOLUME SAMPLER SITES
BASED ON ANNUAL GEOMETRIC MEAN
1975

RANK	SITE AND LOCATION		ANNUAL GEOMETRIC MEAN ($\mu g/m^3$)
1	751 Center Point Road, N.E.	Cedar Rapids	127
2	Water Pollution Control Plant	Keokuk	118
3	City Hall	Council Bluffs	115
4	Industrial Park, 5299 N.E. 15th	Des Moines	115
5	302 S.E. 18th	Des Moines	110
6	445 First Street, S.W.	Cedar Rapids	104
7	14th Ave. & 10th St., S.E.	Cedar Rapids	101
8	Water Plant	Mason City	98
9	Dodge Park Lift Station	Council Bluffs	95
10	Ninth & Mulberry	Des Moines	92
11	445 First Street, S.W. (EPA)	Cedar Rapids	87
12	Third & Pershing	Davenport	85
13	Fire Station, 331 Scott (EPA)	Davenport	84
14	404 South Second Street	Grimes	83
15	Water Plant	Waterloo	80
16	Public Works Garage	Ankeny	79
17	Beaver Fire Station	Des Moines	78
18	City Hall	Ottumwa	78
	ANNUAL PRIMARY STANDARD		
19	316 East Fifth (EPA)	Waterloo	75
20	1249 McKinley	Des Moines	74
21	Fire Station	Olin	74
22	Water Plant	Marshalltown	74
23	East Seventh & Court	Des Moines	73
24	Water Plant	Keokuk	71
25	Water Works Building	Altoona	70
26	Sewage Treatment Plant	Clinton	67
27	5560 Merle Hay Road	Johnston	66
28	Medical Lab Building	Iowa City	66
29	Crest View Acres	West Des Moines	63
30	Ninth and Mulberry (EPA)	Des Moines	63
31	4426 Council Street, N.E.	Cedar Rapids	62
32	Water Tower, South Kentucky	Mason City	62
33	Monroe School	Davenport	61
	ANNUAL SECONDARY STANDARD		
34	Fire Extension Building	Ames	60
35	First Avenue and 11th Street	Spencer	58
36	Ia. Highway Patrol, 3200 Blk., Elmore	Davenport	58
37	Water Plant	Denison	56
38	Water Plant	Clinton	53
39	5440 Vandalia Road	Pleasant Hill	51
40	Municipal Utilities Building	Rock Rapids	51
41	City Hall	Sioux City	50
42	Pleasant Valley School	Bettendorf	48
43	T. Loring Farm	Webster City	48
44	Cochran Farm	Talleyrand	47
45	Water Plant	Fort Dodge	42
46	City Center	Holstein	39
47	Eagle Point Pump Station (EPA)	Dubuque	39
48	Fire Station #4 (EPA)	Dubuque	38

TABLE IV

RANKING OF HI-VOLUME SAMPLER SITES
BASED ON NUMBER OF TIMES SECONDARY 24-HOUR STANDARD WAS EXCEEDED
1975

RANK	SITE AND LOCATION		NO. OF 24-HOUR SAMPLES EXCEEDING SECONDARY STANDARD
1	Water Pollution Control Plant	Keokuk	19
2	Industrial Park, 5299 N.E. 15th	Des Moines	19
3	302 S.E. 18th	Des Moines	17
4	751 Center Point Road	Cedar Rapids	14
5	14th Ave. & 10th St., S.E.	Cedar Rapids	13
6	Water Plant	Mason City	13
7	404 South Second Street	Grimes	12
8	Ninth and Mulberry	Des Moines	10
9	City Hall	Council Bluffs	10
10	445 First Street, S.W.	Cedar Rapids	8
11	Dodge Park Lift Station	Council Bluffs	7
12	Public Works Garage	Ankeny	6
13	28th St. & First Avenue	Cedar Rapids	6
14	5560 Merle Hay Road	Johnston	5
15	Fire Station	Olin	5
16	Sewage Treatment Plant	Clinton	5
17	East Seventh and Court	Des Moines	4
18	City Hall	Ottumwa	4
19	First Avenue & 11th Street	Spencer	4
20	Water Plant	Marshalltown	4
21	T. Loring Farm	Webster City	3
22	Fire Station, 331 Scott (EPA)	Davenport	3
23	Third & Pershing	Davenport	3
24	Water Tower, South Kentucky	Mason City	3
25	Water Works Building	Altoona	3
26	Iowa Highway Patrol	Davenport	3
27	Water Plant	Waterloo	3
28	4426 Council Street, S.E.	Cedar Rapids	2
29	Cochran Farm	Talleyrand	2
30	445 First Street, S.W. (EPA)	Cedar Rapids	2
31	Municipal Utilities Building	Rock Rapids	2
32	1249 McKinley	Des Moines	2
33	Ninth & Mulberry (EPA)	Des Moines	2
34	Beaver Fire Station	Des Moines	2
	24-HOUR STANDARD		
35	Municipal Water Plant	Denison	1
36	Crest View Acres	West Des Moines	1
37	Water Treatment Plant	Keokuk	1
38	316 E. 5th (EPA)	Waterloo	1
39	Fire Extension Building	Ames	1
40	80 Fourth Street	Central City	1
41	City Hall	Sioux City	1
42	Municipal Water Plant	Fort Dodge	1
43	City Center	Holstein	0
44	5440 Vandalia Road	Pleasant Hill	0
45	Water Works Company	Clinton	0
46	Medical Lab Building	Iowa City	0
47	213 First Street West	Mt. Vernon	0
48	Eagle Point Pump Station (EPA)	Dubuque	0
49	Fire House #4 (EPA)	Dubuque	0
50	Pleasant Valley School	Bettendorf	0
51	Monroe School	Davenport	0

IV AIR QUALITY MAINTENANCE AREAS

DEQ has undertaken the task of examining air quality maintenance areas (AQMA's) as required in the Clean Air Act. Point sources (e.g. power plants, cement plants, asphalt plants, etc.) and area sources (e.g. open burning, fugitive dust, automobiles, etc.) emission distributions will be analyzed for every AQMA. Results obtained from the analysis will help develop any necessary control strategies needed in the air basin being affected by those emissions.

Six Standard Metroplitan Statistical Areas have been identified by the EPA Administrator as AQMA's for particulates. These are: Linn County (Cedar Rapids), Polk and Warren Counties (Des Moines), Black Hawk County (Waterloo), Douglas and Pottawattamie Counties (Omaha-Council Bluffs), Scott County (Davenport), and Dubuque County (Dubuque). The only city designated as a AQMA for a pollutant other than particulate is Des Moines, which was also designated as a problem area for carbon monoxide. Eleven additional cities have been chosen by DEQ for future analysis, therefore helping to expand the knowledge of potential concentrations statewide. The cities designated are: Keokuk, Fort Madison, Burlington, Muscatine, Clinton, Iowa City, Ottumwa, Ames, Fort Dodge, Mason City, and Sioux City.

To develop a dynamic picture of particulate concentrations in Iowa, three years (1972, 1976, and 1985) have been chosen as years of analysis for the seventeen areas listed above.

1972 Analysis of this year will illustrate particulate concentrations when emission controls were only beginning to appear in Iowa.

1976 Analysis of this year will project particulate concentrations when emissions should be completely controlled according to the existing State Implementation Plan strategy for controlling air pollution.

1985 Analysis of this year will project future particulate concentrations to help determine if air quality standards will be exceeded with our existing control strategy because of general growth and expansion in the future.

Pollutant concentrations estimates for these years will be calculated by using the Air Quality Display Model, a computer program that combines point source emissions, area source emissions, and meteorological factors over a specified area and projects the distribution of pollutant concentrations for that area. Figure 5 gives an example of projections for Polk County that were obtained from this model. Solid circles represent the point sources in Polk County. The solid lines are isopleths of predicted particulate concentrations as an annual arithmetic mean. Isopleths of high concentration (greater than 80) help illustrate areas that may exceed National Ambient Air Quality Standards. To help calibrate this model for more accuracy, actual air pollutant concentrations obtained from monitors in Des Moines were correlated with projected concentrations.

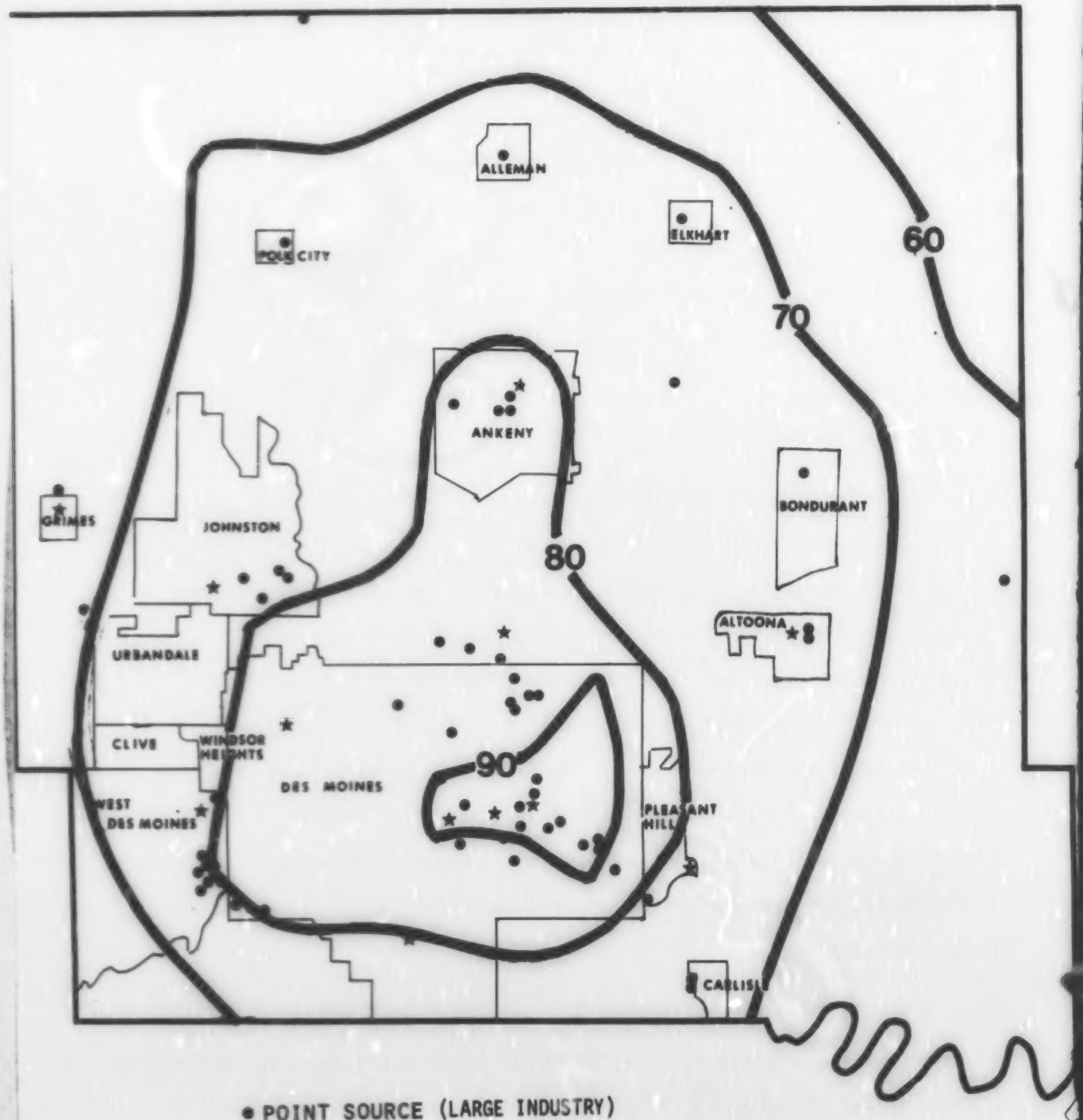
Results from Polk County indicated that in most cases the monitors correlated closely with predicted annual means in urban locations.

All findings were made available to affected local planning agencies, affected local pollution control agencies, affected states adjacent to Iowa, and the federal EPA to encourage a collaborative approach to devising air quality strategies. Meetings with these agencies have recently been completed and preliminary strategies for suspended particulate control have been submitted to EPA.

FIGURE 2

PROJECTED 1976 ISOPLETH MAP FOR

PARTICULATE CONCENTRATIONS IN POLK COUNTY



VII. SUMMARIZATION OF 1975 LEAF BURNING STUDY IN DES MOINES

Introduction

During the autumn of 1975 the Department of Environmental Quality conducted a study to determine the impact on local air quality that results from open burning of leaves and other residential landscape waste. The Des Moines (Iowa) Metropolitan Area was chosen for the study site because open burning is permitted by city ordinance for two months in the autumn and for one and one-half months in the spring. Numerous citizen complaints are received by the local air pollution control agencies during these periods, most significantly from persons who suffer from asthma, emphysema, and chronic bronchitis.

In previous years, it was observed that autumn leaf burning occurred most intensely on weekends and that a widespread haze resulted from the numerous small plumes. Diffusion modeling results suggest that open burning could cause increases of up to 5 $\mu g/m^3$ in the particulate annual arithmetic mean and 150 $\mu g/m^3$ in the 24-hour concentration. However, the existing high-volume particulate samplers in Des Moines were sited to be most sensitive to point sources and were operated on the usual six-day cycle, not often enough to assess the impact of short-term leaf burning. Surveys of carbon monoxide levels using hand-held electrochemical monitors during the fall of 1974 indicated elevated concentrations where leaf burning was occurring in residential areas.

While it should be noted that Des Moines is a non-attainment area for both the particulate and carbon monoxide National Ambient Air Quality Standards, excesses of the standards occur less frequently in residential areas, as

opposed to more commercially or industrially developed areas. By the summer of 1975, it was felt that evidence of open burning causing or at least exacerbating standard excesses was sufficient to justify a formal study of leaf burning in Des Moines.

Study Design

In the study design, three new monitoring sites were chosen in residential areas (western, southern, and northeastern Des Moines), well away from point sources and heavy automobile traffic. Each site consisted of a temperature-controlled, single-axle trailer containing an electrochemical carbon monoxide monitor and auxiliary electronics. On top of each trailer was a standard high-volume sampler. Carbon monoxide was monitored continuously and particulates daily during the period of the study. At least one high-volume sampler was adapted for particulate sizing on each day to obtain additional information on the percentage of respirable particulates present when leaf burning was occurring in contrast to when leaf burning was not occurring.

Because carbon monoxide is a direct product of incomplete combustion, it was used partially as a tracer of concentrated leaf burning activity. Further, it was felt that visual observation was an important and valid technique to ensure that leaf burning was being monitored. To this end, aerial photography was employed on three different days to support ground-based observations.

Data Collection and Analysis

The monitoring network was set up in late July of 1975 and operated through late August to obtain particulate and carbon monoxide levels in the residential areas prior to the onset of leaf burning. For 23 days, involving 68 valid total suspended particulate (TSP) samples, neither the primary (260 $\mu g/m^3$) nor the

secondary (150 $\mu g/m^3$) 24-hour particulate standard was exceeded at any of the three sites. The highest observed 8-hour average carbon monoxide concentration was 3 parts per million, which was measured on 37 separate monitoring days. On all days for which particulate sizing was available during this period (15 samples), larger (greater than 7.0 microns) particles predominated. A single aerial photography mission done at 4:00-5:00 p.m. CST on October 11, 1975, during partly cloudy sky cover, yielded photographs of excellent clarity, although the largest industries (portland cement and rubber tire plants) were operating.

The monitoring network was reactivated with the onset of leaf burning in early October and monitoring continued until cold weather in mid-November. During this 50-day period, 108 valid TSP samples were obtained, of which 25 exceeded the secondary 24-hour standard and 4 exceeded the primary 24-hour standard. Of 96 different 24-hour carbon monoxide monitoring periods, 31 had 8-hour concentrations greater than any samples during the summer background sampling, and 2 exceeded the 8-hour standard. TSP and carbon monoxide data are shown in Figure 1. Particulate sizing on days when leaf burning was observed to be most intense indicated that the bulk of the particulate was less than 1.1 micron. The share of respirable particulate as a percentage of the total particulate catch was significantly increased when compared to an average non-burning day, as shown in Figure 2. Particle size distributions obtained during the August background period were very similar to those obtained on fall days when little leaf burning was occurring.

Haze generated by leaf burning covered the entire metropolitan area and obscured aerial photographs taken on two Saturdays. Aerial photographs show

that substantial numbers of leaf fires in one portion of the metropolitan area can fumigate neighborhoods with leaf smoke several miles distant, where few if any leaf fires are present.

When elevated levels of both suspended particulates and carbon monoxide occurred it was generally on weekends when leaf burning activity was observed to be highest. High-volume sampling filters obtained on the worst days were found to smell strongly of leaf smoke several weeks after removal from the device. Carbon monoxide levels peaked hours later in the daily cycle than has been observed with automobile generated carbon monoxide, probably due to leaf fires smoldering late into the evenings.

By taking TSP values during the leaf burning period of October and early November and extrapolating the effect of leaf burning on the annual arithmetic mean, a value of 4 $\mu g/m^3$ is calculated. This is simply done by taking an average of TSP values for each site recorded after October 9 and prior to November 7 and subtracting from that figure the average of all other TSP data recorded at that site during the study. This difference is then weighted as to its effect on the annual average based on the period's length of 29 days (October 9 through November 7) as compared to 365 days per year. Given the rather obvious assumptions of these calculations, the annual effect is in reasonable agreement with values predicted by diffusion models.

In summary, elevated TSP and carbon monoxide concentrations in the Des Moines area during October and November of 1975 can be attributed to leaf burning because:

1) On days for which leaf burning was observed to be intense, high carbon monoxide levels (caused by incomplete combustion of leaves) were coincident with the high TSP levels.

2) Ground based and aerial observations and related photographs illustrate the presence of dense leaf burning smoke during the period beginning October 9 through early November.

3) Smoke is expected to have a mean particle diameter smaller than most other forms of TSP.[9] As shown in Figure 2 for the particle size range of less than 1.1 microns, during the leaf burning period there was a 52% increase over the 27% contribution to total filter catch by weight when no leaf burning was occurring. In the particle size range between 1.1 and 2 microns there was a 125% increase by weight over the 4% contribution to total filter catch on non-leaf burning days.

4) Other variables which may have caused the increase in TSP during October and November (such as lack of precipitation) can be discounted as the principal cause of the increase in TSP noted in Figure 1.

Conclusion

The days on which aerial photography missions were flown during leaf burning (November 1 and 8, 1975), an intense layer of haze covered the city, extending upwards for a few hundred feet. The haze permeated portions of both fringe suburban and central business district areas which had few trees and therefore few leaf fires. Aerial observations were confirmed by ground observations and evidence of haze and acrid leaf burning odor in relatively treeless suburbs of Des Moines. In summary the numerical data collected during this study merely demonstrates what should have been a foregone conclusion based soley on the photographic evidence.

The photographs, air monitoring data, and preliminary diffusion modeling estimates all point toward unrestricted leaf burning in a large residential com-

munity as being environmentally unacceptable. As Robert Ingersoll's statement in 1880 that "I want the sky to be filled with the smoke of American industry"[10] is anachronistic in our present generation, the often used remark, "it wouldn't be autumn without the smell of burning leaves" may soon be equally unfashionable in the larger communities, if it isn't already.

Figure 1.

Distribution of suspended particulate (24-hour averages) and carbon monoxide (highest 8-hour averages in each day) for summer background and fall leaf burning periods.

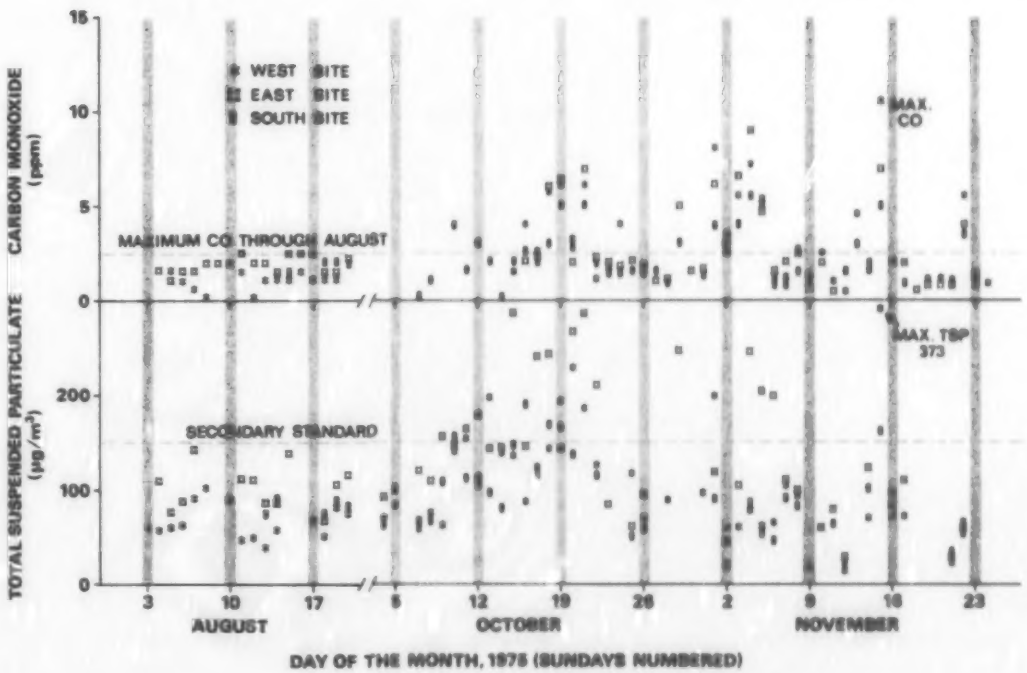
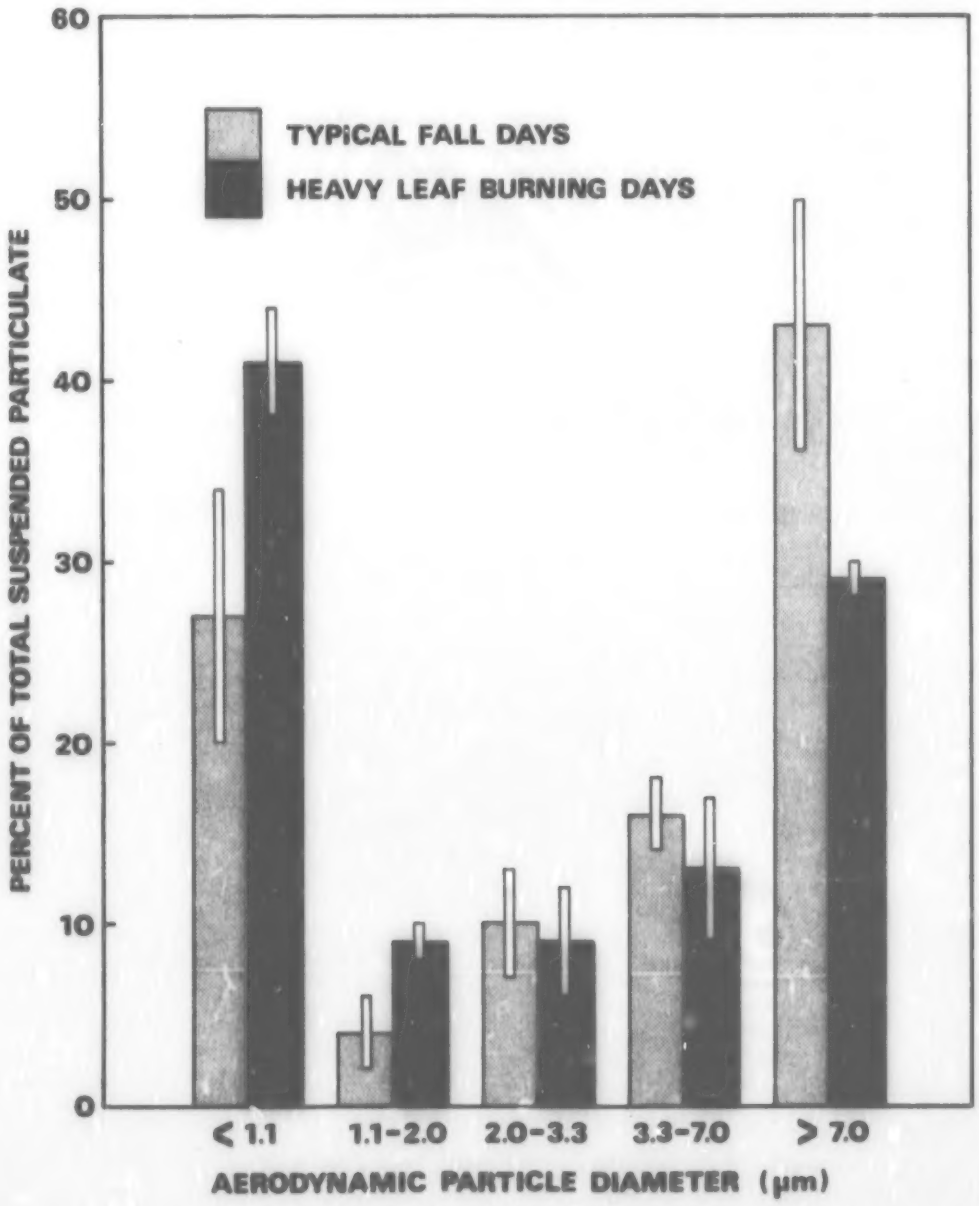


Figure 2.

Bar graph shows changes in particle size distribution of suspended particulate on observed heavy leaf burning days while the vertical lines represent the deviations in the data.



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